THE OHIO JOURNAL OF SCIENCE

VOL. XL SEPTEMBER, 1940 No. 5

A RECORD OF THE BODY WEIGHT AND CERTAIN ORGAN AND GLAND WEIGHTS OF 3690 ANIMALS

GEORGE CRILE, M. D.,
Cleveland Clinic Foundation,
and
DANIEL P. QUIRING, Ph. D.,
Cleveland Clinic Foundation and Western Reserve University,
Cleveland, Ohio

The weight data presented in the following table are offered in the hope that they may be of value to the biologist, physiologist and particularly to the student of growth phenomena. They were collected in Northern Ohio and by several Cleveland Clinic Foundation Expeditions to various parts of the world. These expeditions included one to the South-western area of the United States, one to Brunswick Island, Georgia, one to Africa, one to Key West, Florida, one to the Northeastern arctic territory of Canada and one to Mexico and Guatemala. In addition, certain data are included which have been collected by W. W. Swett and associates of the Bureau of Animal Industry, Department of Agriculture, Washington, D. C., by S. Naccarati, and by Dr. Herbert Clark, Director of the Gorgas Memorial Laboratory, Panama. Certain data on primates were secured through the courtesy of the Department of Physiology of the Yale University Medical School. The material on the horses was made available to us through the co-operation of Dr. W. W. Dimock, head of the Animal Pathology Division of the University of Kentucky, who permitted us to make a large series of dissections in the laboratory of his division. The figures on the gorilla are based on a partial dissection of a specimen at the American Museum of Natural History, through the courtesy of Dr. W. K. Gregory and Dr. H. C. Raven. The data on the human being were obtained through the co-operation of Dr. Harry C. R. Darling, Sidney, Australia; Dr. Nils P. Larsen,

Honolulu, Hawaii; Dr. C. C. Sweet, Ossining, New York; Dr. Carlos Duran, Guatemala; and Dr. John Hertz, Copenhagen, Denmark; and on our own dissections.

With few exceptions, marked with an asterisk, our own data represent fresh weights taken immediately after the animal was sacrificed. The larger animals were weighed on a Chatillon scale of 600 pound capacity, in the case of the heaviest animals this necessitated quartering or cutting the body into sections to fit the scale. The smaller animals were weighed either in a Chatillon autopsy scale, a Cenoco triple beam balance or an Ohaus beam balance. The glands and organs likewise were weighed in these scales except for the very small glands which were weighed in an analytical balance.

It will be noted that some records are more complete than others; this is due in part to changes which were made in our program over the period of some ten years and in part to the impossibility of getting complete records for many of the animals. No attempt has been made to arrange the groups in order of relative development. A rough alphabetical listing has been made.

In connection with the degree of accuracy of the weights, in some instances these have been carried beyond the limits of error. Generally, however, we have attempted to hold to an accuracy of one per cent. In the case of animals which were weighed in pieces, we allowed five per cent for loss of blood and body fluids. All weights represent the body weight plus whatever mass was present in the stomach and intestine.

Under the heading "Remarks," we have given chiefly the locale or country from which the animal was obtained. In certain cases, other pertinent information has been included.

The scientific names have been checked by us and have been examined by Arthur B. Fuller, of the Cleveland Museum of Natural History. If any errors have occurred in naming, the authors take responsibility for them.

BIBLIOGRAPHY

Swett, W. W., Mathews, C. A., Miller, F. W., Graves, R. R. Variations recorded in the study of the conformation and anatomy of 593 dairy cows having records of production. Bureau of Dairy Industry, U. S. Department of Agriculture, Washington, D. C. 1937: 1–23.

Swett, W. W., Miller, Fred W., Graves, R. R., Black, W. H., and **Creech, G. T.** Comparative conformation, anatomy and udder characteristics of cows of certain beef and dairy breeds. J. of Agricultural Res., 55: 239–287, 1937.

Naccarati, Sante. On the relation between the weight of the internal secretory glands and the body weights and the brain weight. Anatomical Record, 24: 255–260, 1922.

INVERTEBRATES

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
			ANNELIDS												
.....	10	.....	Earthworms..... *Lumbricus terrestris*	.00609	.0214	(Ganglia and ventral nerve cord)						.....	.....	.....	Cleveland, O.
			INSECTS												
.....	5	.....	Cockroach..... *Periplaneta americana*	.000092	.000195	(Ganglia and ventral nerve cord)						.....	.....	.....	Cleveland, O.
.....	54	.....	Grasshopper..... *Melanoplus femur rubrum*	.000458	.00233	(Ganglia and ventral nerve cord)						.....	.....	.....	Cleveland, O.
.....	35	M&F	Woodroach..... *Blaberus cranifer*	.004727	.0097	(Ganglia and ventral nerve cord)						.....	.....	.....	Winter Park, Fla.
			MOLLUSCS												
.....	5	.....	Slug..... *Limax maximus*	.00417	.0133	(Ganglia)		.....	.....	.....	.....	.....	.....	.....	Cleveland, O.

VERTEBRATES

AMPHIBIA

650	1	M	Bullfrog..... *Rana catesbiena*	.339	.....	.033	.06	1.37	6.42	2.23	1.73	1.81	.....	.....	North Carolina
1179 1180 1181 1182 1183 1184	6	M	" "	.5199	.4625	.0336	.1342	1.65	14.77	2.57	1.421	2.76	.373	24.56	Louisiana
1139 1140	2	M	Toad, Horned..... *Phrynosoma coronatum*	.025	.1383	.0044	.0093	.1264	.5705	.3927	.6397	.5705	.0311	.....	Arizona
1137 1138 1141	3	F	" "	.0249	.1269	.0070	.0087	.1001	.8857	.2761	.2257	.6174	.0105	.....	Arizona

BIRDS

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
702	1	M	Blackbird..... *Quiscalus quiscula aeneus*	.082	2.92	.0116	.0133	1.159	2.63	1.917	1.299	1.743	.051	6.38	Little Mountain, O.
261	1	F	Bluebird..... *Sialia sialis sialis*	.034	1.281	.006	.022	.383	.....	.....	.....	.....	.....	.....	Little Mountain, O.
262	1	M	" " "	.029	1.392	.0093	.013	.493	.....	.....	.....	.....	.....	.....	Little Mountain, O.
168	1	F	Bustard, Greater..... *Choriotis kori struthiunculus* (Neumann)	5.540	12.94	.44	.33	60.25	98.61	40.25	22.09	70.48	.....	490	Althai Plain, Africa
169	1	M	" "	10.00	15.63	.91	.87	97	200	52.45	66.42	100	.....	655	Althai Plain, Africa
136	1	F	Bustard, Lesser..... *Haliaoetus bociter bociter* (Daubin)	1.100	7.62	.213	.237	11.93	17.63	10.18	6.07	14.35	.....	120	Maji Moto Camp, Africa
15A	1	M	Buzzard, Steppe..... *Buteo vulpinus vulpinus* (Gloger)	.558	7.9	.18	.26	4.58	10.87	.....	3.36	4.64	.....	.....	Maji Moto Camp, Africa
24F	1	M	Buzzard, Turkey..... *Cathartes aura septemtrionalis*	.494	9.3	.115	.156	10.24	20.99	7.95	10.11	14.73	.....	170	Key West, Fla.
266	1	F	Catbird..... *Dumetella carolinensis*	.033	1.412	.004	.004	.327	.....	.....	.....	.607	.....	.....	Little Mountain, O.
706	1	M	Canary..... *Serinus canarius*	.0171	.848	.0193	.0059	.2854	1.010	.336	.2673	.2516	.0184	2.296	Cleveland, O.
1258	1	F	" "	.0153	.564	.009	.007	.133	.738	.230	.....	.....	.....	1.74	Cleveland, O.
265	1	F	Cowbird..... *Molothrus ater ater*	.066	2.693	.014	.017	1.06	.....	.....	.....	.....	.....	.....	Cleveland, O.
55A	1	F	Crane, Crested..... *Balearica pavonina*	4.071	13.54	.34	.38	41.21	125	12	30.34	46.21	.....	.....	Lake Manyara, Africa
56A	1	M	" "	4.825	12.85	.265	.30	32.37	86.1	11.2	21.62	42.05	.....	.....	Lake Manyara, Africa

60	1	M	Crane, Grey..... *Crus canadensis*	1.651	8.58	.14	.248	19.01	29.34	10.97	11.71	15.33	.67	78.59	Key West, Fla.
241	1	M	Crow..... *Corvus brachyrhynchos*	.337	9.3	.038	.077	3.2	.....	.....	.....	9.97	.....	.....	Little Mountain, O.
50F	1	F	Dovekie..... *Alle alle*	.102	1.93	.008	.015	1.24	2.51	1.94	1.88	1.41	.....	6.60	Key West, Fla.
51F	1	M	" "	.104	1.92	.009	.037	1.24	4.34	2.00	2.31	1.91	.....	6.74	Key West, Fla.
646	1	M	Duck..... *Nyroca affinis* (Eyton)	1.041	.....	.133	.152	13.4	58.3	2.9	18.1	17.6	.....	.....	Willoughby, O.
29	1	F	Duck, Pintail..... *Dafila acuta tzitzihoa*	.670	4.9548	.0559	.0818	8.34	30.33	1.70	8.14	17.13	.89	99.43	Churchill, Canada
154	1	F	Eagle, Fish..... *Haliaetus vocifer vocifer*	3.500	12.93	.28	.40	32.23	46.28	22.28	18.43	47.33	.....	150	Africa, Maji Moto Camp
5 22	2	F	Eagle, Tawny..... *Aquilla rapax rapax* (Temninick)	2.625	14.09	.19	.45	18.54	43.45	32.84	14.16	.....	.....	.....	Maji Moto Camp, Africa
88	1	M	" "	1.67	13.62	.12	.35	9.24	42.73	30.2	3.82	27	.....	150	Maji Moto Camp, Africa
11 12	2	M	" "	2.438	13.91	.31	.50	14.17	37.55	30.9	13.57	23.18	.....	.....	Maji Moto Camp, Africa
114A	1	F	Egrette, Great White.. *Casmerodius albus melanorhynchos* (Wagler)	1.03	6.12	.13	.21	9.25	33.02	.....	8.16	33.10	.....	.....	Africa, Maji Moto Camp
113A	1	M	Egrette, Yellow-Bill... *Mesophyox intermedia brachyrhyncha* (Brehm)	.525	4.7	.07	.14	5.0	16.53	5.16	3.72	5.35	.....	.....	Africa, Maji Moto Camp
109 110 111	3	F	Flamingo..... *Phoeniconaias minor* (Geoffroy)	1.483	6.99	.27	.34	14.68	40.27	2.97	17.02	21.35	.....	.....	Africa, Maji Moto Camp
16 17	2	M	" "	1.598	8.05	.57	.59	13.53	40.91	3.82	19.0	23.32	.....	.....	Africa, Maji Moto Camp
718 719 720 721	4	F	Fowl, Leghorn..... *Gallus bankvia*	1.263	3.916	.2153	.186	.....	.....	.....	10.05	10.48	2.20	90.99	Cleveland, O.
.....	7	F	" "	.0437	.9971	.0038	.0095	.....	1.8524	.....	.....	.....	.....	.....	6 days old
.....	13	M	" "	.0464	1.0556	.0036	.0147	.....	1.6242	.....	.....	.....	.....	.....	6 days old
.....	6	F	" "	.0682	1.2107	.0063	.0163	.....	3.4482	.....	.....	.....	.....	.....	13 days old
.....	14	M	" "	.0801	1.3378	.0083	.0185	.....	3.1548	.....	.....	.....	.....	.....	13 days old

BIRDS—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
.....	15	F	Fowl, Leghorn.....	.1197	1.5001	.0094	.0198	.....	4.2529	.....	.....	.....	.....	.....	20 days old
.....	15	M	" "	.1197	1.5411	.0089	.0263	.....	4.2091	.....	.....	.....	.....	.....	20 days old
.....	12	F	" "	.1719	1.7148	.0132	.0228	.....	5.1676	.....	.....	.....	.....	.....	27 days old
.....	8	M	" "	.1601	1.7039	.0113	.0254	.....	5.0124	.....	.....	.....	.....	.....	27 days old
.....	10	F	" "	.2231	1.9261	.0167	.0305	.....	6.1386	.....	.....	.....	.....	.....	35 days old
.....	10	M	" "	.2273	1.9173	.0143	.0368	.....	6.6918	.....	.....	.....	.....	.....	35 days old
.....	12	F	" "	.2951	2.1168	.0233	.0390	.....	8.4172	.....	.....	.....	.....	.....	48 days old
.....	8	M	" "	.3168	2.1142	.0198	.0441	.....	9.0164	.....	.....	.....	.....	.....	48 days old
.....	6	F	" "	.3978	2.3487	.0300	.0498	.....	11.843	.....	.....	.....	.....	.....	62 days old
.....	11	M	" "	.3918	2.3334	.0294	.0611	.....	13.719	.....	.....	.....	.....	.....	62 days old
.....	10	F	" "	.3596	2.3811	.0689	.0864	.....	11.032	.....	.....	.....	.....	.....	87 days old
.....	10	M	" "	.3532	2.4980	.0536	.1135	.....	12.365	.....	.....	.....	.....	.....	87 days old
.....	10	F	" "	.4907	2.5822	.1097	.0989	2.80	12.761	3.34	3.83	3.88	.78	.....	108 days old
.....	10	M	" "	.5007	2.8056	.0631	.1265	3.18	15.305	3.75	4.34	4.39	.68	.....	108 days old
.....	16	F	" "	.6151	2.7224	.0762	.0973	3.91	14.498	3.58	4.17	3.78	.95	.....	136 days old
.....	8	M	" "	.7331	2.9279	.0894	.0714	4.19	16.188	4.25	4.54	4.41	.97	.....	136 days old
602	1	M	Fowl, White Orpington *Gallus bankvia*	2.200	3.55	.140	.260	8.78	45.9	6.39	12.9	13.17	.....	.....	Cleveland, O.
18A	1	F	Goose, Egyptian..... *Alopochen aegyptiaca*	1.935	7.64	.34	.42	18.51	34.31	.....	9.75	35.2	.....	.....	Lake Manyara, Africa
186A	1	M	Guinea Fowl..... *Numida meleagris*	1.620	4.20	.293	.36	14.22	28.6	.....	7.34	29.08	.....	.....	Maji Moto Camp, Africa
25	1	M	Gull, Bonepartes..... *Larus philadelphia*	.205	2.49	.0216	.0529	3.44	9.12	3.14	3.20	7.12	.....	21.56	Churchill, Canada
44F 10F	2	F	Gull, Herring..... *Larus argentatus*	.535	5.08	.040	.133	5.24	27.33	7.74	.....	.....	.....	.....	Key West, Fla.
53F	1	F	Gull, Ring-Billed..... *Larus delawarensis*	.720	8.72	.051	.12	7.35	23.51	8.74	7.45	9.13	.....	154	Key West, Fla.
21F	1	F	Gull, Shearwater..... *Puffinus griseus*	.268	3.01	.031	.049	2.46	10.03	3.27	3.23	2.45	.....	18.21	Key West, Fla.

145	2	F	Hawk, Red-Tailed	.....	.....	.107	.114	.....	.....	.....	1.216	.....	.....	.....	Little Mountain, O.
146			*Buteo borealis*												
681	1	F	" "	1.029	10.025	.0656	.2035	6.94	14.10	21.22	6.87	9.27	.....	18.38	Juvenile, Willoughby, O.
229	1	F	Hawk, Sharp-shinned.. *Accipiter velox velox* (Wilson)	.520	5.70	.042	.110	3.70	.....	.....	.....	7.7	.....	.....	Little Mountain, O.
58F	1	M	Hawk, Sparrow..... *Falco sparverius sparverius* (Linnaeus)	.112	2.51	.016	.028	1.12	2.52	3.30	1.11	1.52	.....	7.43	Key West, Fla.
163	1	M	Hornbill, Ground..... *Bucorvus cafer*	2.150	26.25	.23	.25	56.61	57.58	35.45	23.30	52.27	.....	260	Maji Moto Camp, Africa
712	1	F	Hummingbird..... *Amazilia tzacatl tzacatl* (De la Llave)	.0048	.1998	.00045	.00035	.1138	.2511	.1201	.0391	.0951	.....	.....	Samayac, Guatemala
55B	1	F	Loon, Red-Throated... *Gavia stellata*	1.530	6.12	1.33	.223	22.72	60.87	5.47	22.71	22.62	.....	97.42	Tavane, Canada
55A	2	M	" "	1.568	6.38	.210	.219	22.24	74.02	4.89	27.61	22.31	.....	.....	Tavane, Canada
55C															
52F	1	M	Man-O'-War..... *Fregata aquila*	1.405	9.45	.089	.175	16.59	35.88	12.99	.....	.....	.....	.....	Key West, Fla.
26	1	F	Merganser, Red-Breasted..... *Mergus serrator*	.770	5.289	.0657	.1033	11.01	19.77	2.76	9.67	18.16	.22	46.30	Tavane, Canada
90A	1	M	Ostrich, Masai..... *Struthio camelus massaicus* (Neumann)	123.	42.11	17.33	23.01	1205	2050	.....	920	2900	.....	23133	Maji Moto Camp, Africa
143	1	M	" "	.....	.....	5.5	.....	.....	.....	.....	256	.....	.....	.....	Zoo Specimen, Cleveland, O.
225	1	M	Owl, Horned..... *Bubo virginianus virginianus*	1.177	13.70	.085	.165	8.60	.....	.....	.....	10.7	.....	.....	Little Mountain, O.
6A	1	M	Partridge..... *Francolinus sephaena*	.208	1.50	.02	.043	1.46	8.65	.....	2.70	.....	.....	.....	Maji Moto Camp, Africa
7F	2	F	Pelican..... *Pelicanus occidentalis*	3.290	17.45	.183	.993	22.12	73.15	12.73	.....	29.83	.....	255	Key West, Fla.
23F															
1257	1	M	Pheasant..... *Phasianus colchicus*	.625	3.289	.051	.12	2.84	9.175	5.32	4.82	5.61	.....	56.5	Little Mountain, O.
263	1	M	Phoebe..... *Sayornis phoebe*	.0181	.793	.006	.005	.207	.207	.....	.....	.....	.....	.....	Little Mountain, O.

BIRDS—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
264	1	F	Phoebe	.0175	.750	.0025	.0055	.165	.....	.....	.....	.....	.....	.....	Little Mountain, O.
271	1	F	Pigeon *Columba livia*	.247	2.285	.031	.046	4.651	.....	.....	.....	.....	.....	.....	Little Mountain, O.
268 269 270 24A	3	M	" "	.282	2.694	.028	.0421	4.836	.....	.....	.....	.....	.....	.....	Little Mountain, O.
24C 24D	3	M	Ptarmigan, Willow *Lagopus lagopus*	.542	2.377	.0255	.0273	7.863	12.99	2.316	3.87	9.61	.....	.....	Churchill, Canada
24B	1	F	" "	.540	2.800	.017	.036	9.46	13.405	3.022	4.870	10.74	.....	.....	Churchill, Canada
108	1	F	Raven *Corvus corax*	.....	.....	.031	.....	.....	.....	.....	2.428	.....	.....	.....	Catalina Mountains, Arizona
259 260	2	M	Robin *Turdus migratoris migratoris*	.0693	2.09	.0105	.0213	1.018	1.677	.....	.....	.....	.....	.....	Little Mountain, O.
28	1	F	Scaup, Greater *Nyroca marila*	.787	4.7859	.0855	.1850	8.00	23.00	1.76	9.11	18.01	.....	99.15	Churchill, Canada
.....	11	F	Sparrow *Passer domesticus*	.02326	1.0185	.0041	.0069	.3926	1.0873	.5179	.357	.3996	.0428	2.681	Cleveland, O.
.....	75	M	" "	.02357	1.0278	.0042	.0063	.4077	1.2062	.4591	.345	.3674	.0426	2.698	Cleveland, O.
255	1	F	Sparrow, Song *Melozpiza melodia melodia*	.021	1.10	.0145	.005	.235	.....	.....	.....	.....	.....	.....	Cleveland, O.
14A	1	M	Stork, Abdim *Sphenorhynchus abdini* (Lichenstein)	.950	7.3	.23	.46	8.40	27.94	8.88	8.80	10.36	.....	.....	Maji Moto Camp, Africa
84A	1	M	Stork, European *Ciconia ciconia ciconia* (Linnaeus)	3.350	16.24	.43	.49	28.75	71.4	9.15	26.24	27.2	.....	.....	Maji Moto Camp, Africa
82A 83A	2	F	" "	3.334	15.78	.40	.44	32.12	61.06	16.5	19.84	33.64	.....	.....	Maji Moto Camp, Africa

195A	1	M	Stork, Hammerhead... *Scops umbretta*	.3175	3.93	.037	.061	7.22	.....	.....	.....	8.16	.....	.....	Maji Moto Camp, Africa
107A 108A	2	M	Stork, Marabou..... *Leptoptilos crumeniferous* (Lesson)	7.130	30.14	.64	2.06	55.24	110	27.89	42.94	72.23	.....	692	Maji Moto Camp, Africa
257	1	M	Swallow, Barn..... *Hirundo erthrogaster*	.0215	.904	.006	.007	.302	.....	.....	.....	.....	.....	.....	Little Mountain, O.
256 258	2	F	" "	.021	.879	.0083	.0085	.....	.....	.....	.....	.....	.....	.....	Little Mountain, O.
27	1	F	Teal, Green-winged.... *Nettion carolinensis*	.305	3.116	.0281	.0430	2.88	8.17	1.16	3.105	9.218	42.0	33.84	Churchill, Canada
.....	10	F	Starlings..... *Sturnus vulgaris*	.05835	1.8248	.0063	.0113	.8688	2.1952	1.056	1.080	1.089	.0411	5.6575	Cleveland, O.
.....	15	M	" "	.05736	1.8701	.0063	.0147	.9293	1.9874	.8384	.9829	1.0736	.0665	5.2473	Cleveland, O.
9A	1	F	Vulture..... *Pseudogyps africanus*	5.270	19.60	.40	.46	37.85	70.20	16.24	35.80	.....	.....	.....	Maji Moto Camp, Africa

CARNIVORES

132	1	M	Bear, American..... *Euarctus americanus*	.....	.....	.....	25.0	6.0	.....	.....	.....	176.5	.....	.....	Zoo specimen, Detroit, Mich.
600	1	F	Bear, Grizzly..... *Ursus horribilis*	142.88	233.9	53.6	65.5	1132.5	.....	.....	547.8	.....	304	.....	Zoo specimen, Cleveland, O.
624	1	M	Bear, Polar..... *Thalarctos maritimus*	199.57	489	17.3	10.8	1161	4539	10.1	1292	1701	245	8164	Zoo specimen, Cleveland, O.
567	1	F	" "	317	507	21.5	29.8	1220	4126	.....	730	2580	.....	.....	Zoo specimen, Cleveland, O.
103	1	F	Cat, Civet..... *Spilogale arizonae arizonae*	.....	6.0	.028	.086	.....	.....	.....	3.78	.....	.....	.....	CatalinaMountains, Arizona
99	1	M	" "	.....	.....	.007	.072	.....	.....	.....	4.34	.....	.....	.....	CatalinaMountains, Arizona
.....	1	.....	Cat, Domestic..... *Felis domesticus*	.576	16.0	.....	.5	3.0	31.	.....	7.5	7.5	2.5	.....	Juvenile, Panama
.....	2	M&F	" "	1.542	18.0	.....	1.	10.	86	.....	16.5	15.	6.5	.....	Adult, Panama
756 48F	2	F	" "	2.885	23.46	.21	.639	12.38	92.67	10.06	22.07	32.6	6.48	355	Key West, Fla.

CARNIVORES—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
232, 1253, 1254, 632, 749	5	M	Cat, Domestic	3.778	28.37	.408	.571	16.82	126.8	9.67	44.5	42.7	11.7	33.4	Cleveland, O.
36F	...	M	" " (feralized)	5.012	28.23	.460	.795	19.61	184.2	11.86	49.94	28.47	11.02	.....	Key West, Fla.
10A, 67A	2	M	Cat, Genet *Genetta tigrina suahelica* (Matschie)	1.302	15.89	.29	.49	7.51	49.68	3.72	8.93	12.99	.....	.....	Maji Moto Camp, Africa
153A	1	F	" "	1.525	15.35	.04	.19	8.46	58.54	344	14.05	22.55	.....	97	Maji Moto Camp, Africa
104, 113	2	M	Cat, Ringtailed *Bassariscus astutus*	.....	17.1	.083	.353	.....	.....	.....	11.6	.....	.....	.....	Arizona
152A	1	F	Cat, Wildcat *Felis ocreata*	2.700	28.48	.10	.19	5.86	32.75	6.41	10.07	9.0	.....	78	Maji Moto Camp, Africa
148	1	M	Cheetah *Acinonyx jubatus*	22.20	2.449	1.09	.....	.....	.....	82.5	.....	.....	.....	.....	Zoo specimen, Cleveland, O.
1292	1	M	" "	40.82	.....	13.05	2.91	159	1000	49	145	360	47.2	.....	Zoo specimen, Cleveland, O.
.....	1	.....	Coati mundi *Nasua narica panamaensis* (Allen)	.399	23.3	.....	.4	2.0	17.5	.....	4.0	5.3	1.8	.....	Adult, Panama
714	1	M	" "	6.25	44.17	1.54	.54	37.97	150	2.33	.....	.....	5.50	.....	Guatemala
667	1	F	Coyote *Canis latrans*	8.510	84.24	.6901	1.049	72.71	292.5	11.11	80.07	61.28	14.21	.....	Cedar Vale, Kansas
89	1	F	" "	.....	80.0	1.8	.560	.....	.....	.....	80.69	.....	.....	.....	Kaibab Forest, Arizona
213A, 214A, 216A	3	M	Dog *Canis familiaris*	14.56	79.99	1.14	1.74	127	760	10.97	84.8	362	.....	1553	Maji Moto Camp, Africa—African mongrel

180A 212A	2	F	Dog	12.47	81.14	1.35	1.45	120	665	13.11	88	288	.....	1430	Maji Moto Camp, Africa
673	1	M	Greyhound	24.49	105.9	2.34	3.36	308.8	1067	12.36	158	363.5	175	.....	Memphis, Tenn.
35 57	2	M	Huskies	31.75	130.7	2.85	3.16	297	1438	10.88	248	431	.....	1944	Churchill, Canada
276	1	M	"	26.94	79.3	11.3	10.6	.....	.....	.....	216.2	.....	.....	.....	Zoo—originally from Alaska
8F 228F	2	F	Mongrel	14.75	66.53	1.11	1.09	95.4	300	9.73	44.65	108.1	.....	712	Key West, Fla.
362 204 120	2	M	"	11.26	87.6	3.36	1.54	126.3	465.2	16.85	.....	138.4	.....	.....	Cleveland, O.
369 370 367	4	F	Dog, Collie-Police	23.71	84.63	2.93	2.07	182.6	693	.....	152	192.7	.....	.....	Cleveland, O.
.....	1	.....	" " "	19.28	90	8.6	7.0	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
615	1	M	Dog, Police	38.42	95.2	23.8	6.1	261	.....	.....	.....	.....	.....	.....	Cleveland (goiter)
134	1	F	Fox, Bat-eared *Otocyon megalotis*	3.335	26.09	.49	.49	24.65	125	4.65	31.91	35.05	.....	660	Maji Moto Camp, Africa
90 91	2	F	Fox, Grey *Urocyon cinereo argenteus scotti*	.....	32	.066	.222	.....	.....	.....	17.17	.....	.....	.....	White Tank Mts., Arizona
69F 92	1	M	" "	3.749	37.28	.154	.390	21.97	50.80	4.02	17.43	19.12	.....	425	Miami, Fla.
95 100 115	4	M	" "	.....	35.2	.266	.329	.....	.....	.....	24.09	.....	.....	.....	White Tank Mts., Arizona
138	1	F	Fox, Red *Vulpes fulva* (Desmarest)	.....	.....	.405	.420	.....	.....	.....	24.95	.....	.....	.....	Little Mountain, O.
647	1	F	" "	4.625	53.30	.1469	.5285	41.75	.....	4.18	.....	.....	.....	.....	Churchill, Canada
648	1	M	Fox, White *Vulpes lagopus innuitus* (Merriam)	3.385	44.50	.763	.353	.....	.....	5.8	.....	.....	.....	.....	Churchill, Canada
138A 28A	2	.....	Hyena, Spotted *Crocuta crocuta*	62.37	175	6.68	15.08	447	3194	40.42	400	6809	.....	6804	Maji Moto Camp, Africa
95A 140	2	M	Jackal *Thos mesomelas*	2.85	46.	.78	.508	21.33	122.5	6.8	23.03	30.08	.....	308	Lake Manyara and Katetti, Africa
678	1	F	Jaguar *Felis onca*	34.47	147	1.72	7.46	186	894	17.28	164.5	576	62.12	.....	Zoo specimen, Jungle bred, S. Amer.

CARNIVORES—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
709	1	F	Kinkajou *Potos flavus aztecus*	2.62	31.05	.56	.19	14.3	98.6	1.9	.....	78.5	.....	.....	Guatemala City, Guatemala
608	1	M	Leopard *Felis pardus*	48	135	48.55	6.93	200	900	31.4	.....	500	104.3	.....	Hyperplastic thyroid, zoo, Detroit, Mich.
561	1	F	Leopard, Infant	8.618	121	1.3	2.3	52	278	.....	86	183	.....	.....	Zoo, Cleveland, O.
144	2	F	Lion, Cubs	56.69	167	87.08	7.81	345	1182	.....	325	.....	.....	.....	Zoo, Cleveland, O.
267			*Felis leo*												
1144	1	F	" "	20.41	163	4.415	9.20	144.6	723.8	31.3	193.7	334.2	46.4	.....	Zoo, Cleveland, O.
131	2	F	" "	87.34	.....	16.33	8.62	391.1	.....	.....	.....	.....	.....	.....	Zoo, California
185															
219															
579	3	M	" "	124	229.2	636.9	15.51	1163	.....	51.8	.....	2600	157.7	.....	Zoo specimen, Philadelphia and Cleveland, O.
689															
37A	2	M	" "	190.8	258	20.57	32.73	1018	5725	59.23	1610	2300	825	.....	Maji Moto Camp, Africa
38A															
612	1	M	Lion, Mountain *Felis oregonensis*	28.79	106.7	2.20	9.6	184	1255	9.2	131.7	326	.....	.....	New Mexico
106	1	F	" "	.....	.....	1.6	4.1	.....	.....	.....	140	.....	.....	.....	Catalina Mountains, Arizona
98	1	M	Lynx *Lynx baileyi*	.....	.....	.35	.60	.....	.....	.....	24.6	.....	.....	.....	Florence, Arizona
159A	1	M	Mongoose *Ichneumia albicauda*	4.40	28.30	.21	.61	28.84	61	4.0	34.96	58	.....	275	Maji Moto Camp, Africa
571	1	M	Puma *Felis bangsi costaricensis* (Merriam)	25.96	129	1.40	10.2	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	1	.....	Raccoon *Procyon lotor pumilis* (Miller)	5.175	40.	1.33	3.22	.....	.....	.....	.....	.....	.....	.....	Adult, Panama

64	1	F	" "	2.226	33.55	.190	1.55	19.73	140	3.32	35.85	19.41	.....	225	Key West, Fla.
562	1	F	" "	4.536	40.5	.195	1.4	31.2	136	.....	37	38	13.8	.....	Zoo specimen, Cleveland, O.
563	1	M	" "	5.216	42.7	.261	.9	42.5	187	.....	35.7	187	13.6	.....	Goiter—Zoo, Cleveland, O.
168F	1	F	" "	.....	.....	.222	1.651	.....	.....	.....	.....	.....	.....	.....	Cumberland Island, Georgia
321	1	M	Skunk..... *Mephitis mephitis*	1.700	10.3	.274	.468	9.82	45.7	.....	10.1	.....	.....	.....	New York State
110 127	2	F	" "	2.260	10	.096	.348	.....	.....	.....	.....	.....	.....	.....	Cleveland
102 111	2	M	Skunk, Hog-nosed..... *Conepatus mesoleucus*	.....	15.5	.068	.279	.....	.....	.....	7.51	.....	.....	.....	Catalina Mountains, Arizona
117	1	F	" "	.....	16.0	.054	.211	.....	.....	.....	7.51	.....	.....	.....	Arizona
139	1	M	Serval..... *Felis capensis*	9.955	66.74	.42	1.03	37.3	225	18.02	100	125	.....	400	Maji Moto Camp, Africa
87 151	2	F	" "	5.819	53.16	.33	.40	28.45	86.18	10.23	40.34	50.72	.....	350	Maji Moto Camp, Africa
288	1	F	Tiger..... *Felis tigris*	160.	225	68.2	16	432	1818	.....	.....	1020	915	.....	Zoo specimen, Cleveland
261	1	M	" "	209.	302	50.5	20.8	698	.....	.....	.....	1888	.....	.....	Jungle bred captive
53A 53B 53C	3	M	Weasel, Arctic..... *Mustela arctica*	.1693	5.64	.108	.015	2.83	9.67	.153	1.80	3.85	.713	.....	Tavane, Canada
782	1	F	" "	.121	3.47	.015	.030	1.95	5.5	.110	1.81	3.60	.....	.....	Cleveland, O.
627	1	M	Wolf, Russian..... *Canis lupus lupus*	22.68	119	13.	2.4	246	626	18.20	187	807	.....	.....	Zoo specimen, Cleveland, O.
672	1	M	Wolf, Timber..... *Canis lubilus*	29.94	152	3.49	3.37	315	925	16.84	223	379	44.3	.....	Ely, Minnesota

PINNEPEDIA

40	1	F	Seal, Bearded..... *Erignathus barbatus*	....	109.7	.....	6.13	6.95	515	.....	.....	.....	.....	.....	.....	Juvenile, Chesterfield Inlet, Canada
39	1	F	" "	....	281.	460	22.83	22.04	1245	5454	63.06	1320	4536	.....	26330	Chesterfield Inlet, Canada
613	1	M	Seal..... *Phoca richardi geronimensis*	....	107.3	442	10.02	6.27	1435	4485	60.72	894	1880	520	.....	California

PINNEPEDIA—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
149	1	M	Seal.....	.....	378	5.2	6.0	.....	.....	.....	418	.....	.....	.....	Zoo specimen, Cleveland, O.
18 31 37	3	M	Seal, Ringed..... *Phoca hispida*	39.46	251	3.49	2.49	281	1244	73.34	249	738	101	2992	Churchill (2), Chesterfield Inlet (1), Canada
36 41	2	F	" "	39.68	255	3.44	3.41	302	930	70.20	236	730	150	.....	Chesterfield Inlet, Canada
45	1	M	Walrus..... *Odobenus rosmarus* (Linnaeus)	79.38	.....	.....	.....	.....	3625	.....	.....	.....	520	.....	3 months old, Churchill, Canada
38	1	F	" "	55.79	737	13.68	7.20	650	2300	13.2	725	1625	200	2425	3 months old, Keewatin, Chesterfield Inlet
43	1	M	" "	667	1126	70.04	27.07	4536	19504	26.63	4536	9072	.....	29484	Tavane, Canada
46 47 48	3	M	" "	595.6	.....	66.67	20.15	.....	.....	.....	.....	.....	.....	.....	Walrus Islands, off Tavane, Canada
CETACEA															
70	1	M	Porpoise..... *Phocaena phocaena*	142.43	1735	18.29	10.41	738	2962	57.19	.....	5250	53.02	13255	Key West, Fla.
748	1	.....	Whale, Blue..... *Balaenoptera musculus*	58059	6800	3450	1385	.....	.....	.....	.....	.....	.....	.....	Queen Charlotte Islands, Canada
1 32	2	F	Whale, White..... *Delphinapterus leucas*	303.23	2354	65.94	29.23	1722	4825	22.01	1857	7936	153	9296	Churchill, Canada
7 19 33 34	4	M	" "	441.31	2349	111.04	29.20	2454	6807	31.71	2214	12093	200	12075	Churchill, Canada

CHIROPTERA

.....	5	M&F	Bat, Vampire..... *Desmodus rotundus muriunus* (Wagner)	.028	.936	.028	.012	.....	.....	.....	.....	.....	.....	.....	Adult, Panama

EDENTATES

.....	1	.....	Ant Bear..... *Cyclops didactylus dorsalis* (Gray)	.086	4.11	.15	.72	.....	.....	.....	.....	.....	.....	.....	Panama
.....	1	.....	Anteater..... *Tamanduas tetradactyla chiriquensis* (Allen)	.....	.....	.....	.25	1.0	4.0	.....	2.0	1.0	.5	.....	Infant, Panama
.....	1	.....	" "	1.409	23	.....	1.0	2.0	23.	.....	12.5	16	1.5	.....	Juvenile, Panama
.....	2	M&F	" "	3.692	25	.....	.75	18.0	76.5	.....	21.0	27.0	7.0	.....	Adult, Panama
.....	1	M	Armadillo..... *Dasypus novemcinctus fenestratus* (Peters)	2.086	9.5	.195	.83	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	7	M&F	" "	.471	6.0	.....	.56	2.3	22.3	.....	5.6	5.64	1.6	.....	Infant, Panama
.....	4	M&F	" "	1.392	8.2	.....	1.1	6.0	40.2	.....	11.0	10.5	4.0	.....	Juvenile, Panama
.....	1	F	" "	1.818	8.5	.16	.71	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	1	M	" "	3.701	14.2	.42	.80	14.7	.....	.38	.....	.....	.....	.....	.....
.....	10	M&F	" "	3.401	7.5	.....	1.2	9.0	106	.....	16.3	24.0	7.4	.....	Adult, Panama
.....	1	.....	Sloth, Three-toed..... *Bradypus griseus griseus* (Gray)	.676	15.	.....	1.0	3.0	20	.....	9.0	7.0	2.0	.....	Infant, Panama
.....	1	F	" "	1.115	14	.07	.20	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	1	M	" "	1.601	13.0	.19	.30	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	4	M&F	" "	2.005	.....	.....	1.1	6.1	42	.....	12.5	27.4	6.4	.....	Juvenile, Panama
.....	1	.....	" "	2.894	15	.66	1.16	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	10	M&F	" "	3.121	15.1	.....	.94	7.5	64.1	.....	16.4	29.9	8.0	.....	Adult, Panama
.....	1	F	" "	3.774	18.0	.7	1.15	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	7	M&F	Sloth, Two-toed..... *Choloepus hoffmanni* (Peters)	4.825	23.07	3.307	.6857	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	1	F	" "	5.271	26.0	.30	1.03	.....	.....	.....	.....	.....	.....	.....	Adult, Panama

ELASMOBRANCH FISHES

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
47F	1	M	Ray, Electric *Torpedo torpedo*	.345	.78	.029	.....	.22	6.9	1.3	12.9	.....	.....	.....	Key West, Fla.
1F 73F	2	M	Ray, Sting *Desyatis sabina*	17.58	54.49	1.76	.....	47.58	815	30.67	107.2	.....	.....	410	Key West, Fla.
9F	1	.....	" "	2.675	6.03	.084	.....	6.83	.....	.....	.....	.....	.....	.....	Key West, Fla.
63F	1	F	Shark, Sand *Carcharias littoralis*	35.38	48.8	1.81	.....	41.6	2875	44.24	96.4	.....	98.82	1375	Miami, Fla.
4F	1	M	" "	35.83	50.03	2.57	.....	40.14	2925	52.21	.....	.....	150	750	Key West, Fla.
72F	1	F-P	" "	123	82.55	4.05	.....	115	.....	40.8	.....	.....	.....	.....	Miami, Fla.
74F	1	F	Shark, Tiger *Galeocerdo tigrinis*	200	107.5	12.73	.....	291.5	40370	88.43	.....	.....	.....	.....	Miami, Fla.

BONY FISHES

65F	1	F	Barracuda *Sphyraena barracuda*	4.794	4.34	.064	.....	37.78	38.93	25.25	.....	.....	.....	260	Key West, Fla.
35F	1	M	" "	5.978	3.83	.11	.....	42.25	72.7	29.07	.....	.....	.....	409	Key West, Fla.
59F	1	F	" "	8.654	5.7	.060	.....	51.6	80.31	45.21	.....	.....	13.37	430	Key West, Fla.
31F	1	M	" "	9.130	6.3	.....	.....	60.31	.....	38.39	.....	.....	.....	.....	Key West, Fla.
25F	1	M	Bonita *Gymnosarda alleterata*	6.291	3.57	.051	.....	29.43	128	33.8	.....	.....	20.4	351	Key West, Fla.
1151 1152 1154 1155	4	M	Carp *Cyprinus carpio*	1.0421	1.2833	.0089	.....	1.617	.....	2.865	6.779	.....	2.544	96.44	Cleveland, O.
1153 1156	2	F	" "	1.061	1.191	.0080	.....	1.554	.....	3.142	4.88	.....	2.32	70.10	Cleveland, O.
7A	1	M	Catfish (Of genus *Clarias*)	2.894	1.84	.....	.....	6.1	17.65	.....	16.75	.....	.....	.....	Maji Moto Camp, Africa

91A	1	M	Catfish (Of species *Crilli*)	10.78	8.2	.....	.....	52.2	.....	3.67	76.41	.....	.....	.....	Maji Moto Camp, Africa
1188, 1189	2	M	Cisco *Argyrosomus artedi*	.1621	.2995	.....	.....	.39	1.592	1.08	1.81	.....	.155	10.78	Churchill, Canada
1193	1	F	Codfish *Gadus callarias*	10.6	5.0401	.620	.....	15.90	161.4	60.36	19.93	.....	10.09	580.0	Boston, Mass.
1194, 1197, 1205	3	F	" "	2.625	2.2180	.0257	.....	4.09	97.1	26.91	9.4	.....	2.01	159.7	Boston, Mass.
1195, 1196, 1198	3	M	" "	2.518	1.9792	.0476	.....	3.90	96.2	26.73	11.40	.....	2.15	179.2	Boston, Mass.
2F	1	.....	Eel, Green moray *Gymnothorax funebris*	3.510	.51	.054	1.51	4.62	101.5	1.39	.....	.....	4.28	325	Key West, Fla.
619	1	M	Goldfish *Carassius auratus*	.00554	.069	.009	.....	.014	.....	.....	.....	.....	.....	.....	Cleveland, O.
618	1	F	" "	.00952	.097	.004	.....	.026	.....	.140	.....	.....	.....	.98	Cleveland, O.
49F	1	M	Grouper, Black *Mycleroperca bonaci xanthastica* (Jordan and Swaine)	2.712	1.99	.032	.....	2.08	11.66	13.19	.....	.....	.....	55.47	Key West, Fla.
13F	1	M	Grunt, White *Haemulon plumieri* (Lacepede)	.300	.81	.01	.....	.31	3.55	4.47	.....	.....	.18	5.19	Key West, Fla.
1199, 1200, 1201, 1202, 1203, 1204	6	F	Haddock *Melanogrammus aeglefinus*	3.275	2.0502	.0692	.....	5.71	132.6	26.16	11.08	.....	2.64	291.5	North Atlantic Coast
11	1	M	Hogfish *Lachnolaimis maximus*	.480	.91	.014	.....	.452	3.70	4.97	.....	.....	.35	5.02	Key West, Fla.
43	1	M	Jack, Common *Caranx hippos*	2.305	2.97	.031	.....	4.87	18.7	33.25	.....	.....	2.66	.....	Key West, Fla.
41	1	F	Jack, Yellow *Caranx bartholomoei*	4.274	7.56	.043	.....	11.62	.....	9.52	.....	.....	.....	.....	Key West, Fla.
22	1	M	" "	4.812	4.72	.058	.....	13.96	65.13	20.22	.....	.....	8.7	182	Key West, Fla.
3	1	M	Jewfish *Promoicrops itaiara* (Lichtenstein)	32.89	2.31	.32	.....	49.23	350	33.6	56.8	.....	17	1200	Key West, Fla.

BONY FISHES—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
34	1	M	Kingfish..... *Scomberomorus regalis*	2.43	2.18	.037	.....	5.33	.....	.....	.....	.....	.....	.....	Key West, Fla.
621	1	M	Mackerel..... *Scomberomorus maculatus*	.765	.640	.....	.....	.....	.....	.....	.....	.....	.....	.....	North Atlantic Ocean
19 649	2	F	" "	1.457	1.61	.030	.....	2.93	6.21	7.91	.....	.....	1.7	2.92	Key West, Fla.
20	1	F	Muttonfish..... *Lutianus analis*	2.49	2.09	.048	.....	5.12	14.26	19.15	.....	.....	1.17	.....	Key West, Fla.
61	1	F	Palometa..... *Trachinotus glauous*	8.504	3.08	.110	.....	24.83	86.25	79.13	.....	.....	7.42	302	Key West, Fla.
623	1	F	Perch..... *Perca flavescens*	.192	.337	.002	.....	.44	2.96	1.4	.....	.....	.....	7.92	Lake Erie, Cleveland
1163 1164 1165 1166 1167 1168	6	M	" "	.167	.254	.0035	.....	.3087	1.476	.930	.459	.....	.149	4.85	Lake Erie, Cleveland
617	1	.....	Pike..... *Esox lucius*	.82	.597	.....	.....	.....	.....	3.9	.....	.....	.....	.....	Lake Erie, Cleveland
1157 1158 1160 1162	4	M	" "	.3523	.464	.0047	.....	.660	3.55	4.88	1.777	.....	.421	21.67	Lake Erie, Cleveland
1159 1161	2	F	" "	.3738	.535	.0118	.....	.560	3.780	4.915	1.555	.....	.420	20.8	Lake Erie, Cleveland
1207 1208 1209 1211	4	F	Salmon..... *Salmo salar*	5.361	1.143	.0170	.....	10.72	96.56	8.014	39.59	.....	11.71	230.9	Atlantic Ocean, off Maine Coast

1210	2	M	" "	4.922	1.029	.010	.....	15.22	69.46	7.84	36.20	.....	11.00	216.8	Atlantic Ocean, off Maine Coast
1212															
695	1	M	" "	3.93	1.257	.035	.....	6.42	.....	.....	.....	.....	.....	.....	Atlantic Ocean, off Maine Coast
694	1	F	" "	5.412	1.387	.137	.....	7.92	79.7	8.9	.....	.....	.....	.....	Atlantic Ocean, off Maine Coast
620	1	.....	Smelt..... *Osmerus mordax*	.04766	1.09	.006	.....	1.29	.....	.....	.....	.....	.....	.....	Lake Erie, Cleveland
14	1	M	Snapper, Vermilion.... *Rhomboplites aurorubens* (Cuvier and Valenciennes)	.202	.65	.006	.....	.33	1.76	2.54	.....	.....	.....	3.11	Key West, Fla.
1178	1	M	Trout, Brown..... *Salmo trutta*	.292	.570	.007	.....	.385	3.885	2.29	1.25	.....	1.205	20.10	Castalia, O.
1213															
1214															
1215	5	F	Trout, Northern..... *Cristivomer namaycush*	3.24	1.323	.0134	.....	5.17	52.43	9.33	27.97	.....	1.77	220.3	Manitoulin Island, Ont.
1216															
1217															
1218	1	M	" "	2.50	1.233	.0095	.....	4.34	36.00	7.26	20.92	.....	2.16	154.7	Manitoulin Island, Ont.
1170															
1173	4	F	Trout, Rainbow..... *Salmo irideus*	.2177	.415	.0044	.....	.280	2.156	1.519	1.093	.....	.585	19.35	Adult, Castalia, O.
1174															
1175															
1171	2	M	" "	.2608	.454	.0074	.....	.307	2.598	1.809	1.443	.....	.54	25.	Adult, Castalia, O.
1172															
1176	1	F	" "	.1101	.315	.0022	.....	.155	1.415	1.13	.485	.....	.265	8.00	Yearling, Castalia, O.
1177	1	.....	" "	.0428	.178	.0026	.....	.095	.610	.665	.123	.....	.115	4.25	Infant, Castalia, O.
1185	2	M	Trout, Salmon..... *Salmono gairdneri*	2.75	.818	.0163	.....	6.22	40.74	4.35	20.64	.....	2.86	89.38	Churchill, Canada
1186															
622	1	M	Trout, Speckled..... *Salvelinus fontinalis*	.85	.83	.....	.....	.....	.....	1.9	.....	.....	.....	25.5	Pennsylvania
697	1	F	" "	.255	.439	.....	.....	.99	5.86	2.02	.....	.....	.22	16.01	Pennsylvania
696	1	M	" "	.2301	.466	.....	.....	1.15	3.75	1.94	3.32	.....	.17	28.24	Pennsylvania
26	1	M	Tuna..... *Thunus secundodorsalis*	5.21	3.09	.056	.....	31.22	139	85.81	.....	.....	.....	216	Key West, Fla.
15	1	M	Turbot..... *Balistes caroliniensis*	.295	.872	.005	.....	.364	12.86	3.36	.....	.....	.09	5.4	Key West, Fla.

BONY FISHES—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
1145															
1149	3	M	Whitefish..... *Coregonus clupeaformis*	.7465	.503	.0153	.....	.892	8.84	2.34	7.98	.....	.75	42.88	Lake Erie
1150															
1146															
1147	3	F	" "	.7986	.593	.0091	.....	.973	10.61	2.69	8.2	.....	.60	38.67	Lake Erie
1148															
12	1	F	Yellowtail (fish)..... *Ocyurus chrysurus* (Bloch)	.255	.94	.007	.....	.37	2.41	4.2	.....	.....	.....	7.78	Key West, Fla.
			INSECTIVORES												
631	1	M	Mole..... *Scalopus aquaticus*	.0396	1.16	.0095	.0175	.272	1.548	.....	.629	.737	.....	.....	Little Mountain, O.
.....	39	F	*Shrew..... *Blarina brevicauda*	.0163	.3443	.0021	.0037	.1723	.8896	.0011	.2041	.3575	.....	.....	Cleveland
.....	29	M	" "	.0188	.352	.0026	.0048	.1922	1.092	.0018	.240	.4214	.....	.....	Cleveland
			MARSUPIALS												
.....	2	.....	Opossum..... *Didelphis marsupialis etensis* (Allen)	.215	4.5	.14	.....	.....	.....	.....	.....	.....	.....	.....	Infant, Panama
.....	3	.....	" "	.224	3.3	.....	.38	1.41	13.0	.....	.57	2.3	2.7	.....	Infant, Panama
.....	8	M&F	" "	.666	3.8	.....	1.01	3.4	.....	5.6	8.0	2.83	.....	.....	Juvenile, Panama
.....	4	M&F	" "	1.147	4.8	.....	1.0	5.0	67.	.....	7.5	9.5	.....	.....	Adult, Panama
.....	1	.....	Opossum, Woolly..... *Philander laniger pallidus* (Thomas)	.158	.....	.....	.25	1.5	7.0	.....	2.0	2.0	1.0	.....	Juvenile, Panama
.....	1	.....	" "	.222	.....	.....	1.0	3.0	9.0	.....	4.0	3.0	1.5	.....	Adult, Panama

*Preserved weights.

.....	1	F	Baboon..... *Papio cynocephalus*	7.900	140	.437	2.30	.....	.....	.....	.....	.....	.....	.....	Juvenile, Department of Physiology, Yale Univ.
23A	1	M	" "	19.51	175	1.8	2.05	79.94	367	13.18	70.92	175	.....	.....	Moto Umbo Camp, Africa
93A	1	F	Monkey, Grey..... *Cercopithecus mitis kibonotensis* (Lonnberg)	1.22	50.3	.172	.22	6.56	29.65	.....	7.84	9.98	.....	250	Maji Moto Camp, Africa
92A	2	M	" "	2.9	61.46	.39	.41	7.59	50	9.94	8.71	14.39	.....	350	Maji Moto Camp, Africa
4A	1	M	" "	4.55	66.6	.15	3.05	35.32	106	.....	20.63	41.6	.....	.....	Maji Moto Camp, Africa
.....	10	M&F	Howler, Black..... *Aloutta palliata inconsonans* (Goldman)	.673	42.88	.....	.588	3.9	22.65	.....	6.19	9.88	6.8	.....	Infant, Panama
.....	3	M&F	" "	2.683	48.1	.....	.67	14.1	84.9	.....	15.4	22.7	36.75	.....	Juvenile, Panama
.....	28	M&F	" "	6.174	50.34	.....	1.16	20.67	201	.....	35.95	38.68	45.68	.....	Adult, Panama
.....	2	F	" "	4.309	54.25	.45	.8	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	2	F	" "	6.577	54.05	.55	.95	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	2	M	" "	7.938	53.45	.55	.95	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	2	.....	Howler, Brown..... *Aloutta palliata palliata*	.429	37	.....	.45	1.9	13.3	.....	3.2	6.5	1.7	.....	Infant, Panama
.....	5	M&F	" " "	1.209	37.6	.....	1.6	8.0	41.9	.....	12.5	11.5	2.8	.....	Juvenile, Panama
.....	6	M&F	" " "	3.119	42.3	.....	1.5	7.8	118	.....	21.33	28.3	3.33	.....	Adult, Panama
224	1	F	Humboldt..... *Lagothrix humboldti*	5.26	86.2	.45	1.2	48	.....	.....	.....	63.5	.....	.....	Adult, South America
156A	1	F	Lemur..... *Galago senegalensis*	.20	5.0	.015	.125	1.38	6.03	3.7	1.54	1.44	.....	17.6	Maji Moto Camp, Africa
221	1	F	Lemur, Ring-tailed.... *Lemur catta*	1.725	21.8	.27	.232	8.2	.....	.....	.....	24.7	.....	.....	New York
405	1	F	Macaque, Rhesus..... *Macacus rhesus*	1.39	72.0	.179	.885	5.3	57.2	.....	9.8	.....	.....	.....	Juvenile, Laboratory specimen
.....	7	F	" "	3.627	93.1	.578	.996	12.2	.....	.....	.....	68.5	.....	.....	Yale Univ. and C. C. Lab.
.....	4	M	" "	3.292	91.7	.611	.75	12.7	69	35	.....	.....	.....	.....	Yale Univ. and C. C. Lab.
.....	1	.....	Monkey, Night..... *Aotus zonalis* (Goldman)	.212	.....	.....	1.0	1.5	8.0	.....	2.0	2.0	1.0	.....	Infant, Panama

PRIMATES—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
.....	18	M&F	Monkey, Night.....	1.926	88.6	.785	1.06	7.65	74.5	.....	11.6	17.3	8.6	.....	Juvenile, Panama
.....	11	F	" "	9.163	109	1.28	2.12	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	6	M	" "	8.89	118	1.42	2.23	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	19	M&F	Spider, Red..... *Ateles geoffroyi* (Kuhl)	1.029	74.79	.....	1.04	4.49	42.77	.....	7.76	11.98	14.5	.....	Juvenile, Panama
.....	11	M&F	" " "	2.805	103	.....	1.06	14.52	98.97	.....	16.97	26.99	29.32	.....	Juvenile, Panama
.....	63	M&F	" " "	7.63	107	.....	1.75	32.5	213	.....	31.2	51.38	40.8	.....	Adult, Panama
.....	5	F	" " "	.860	64.0	.175	.585	.....	.....	.....	.....	.....	.....	.....	Infant, Panama
.....	5	F	" " "	5.143	110.6	.798	1.65	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	3	M	" " "	4.999	94.7	.64	2.0	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	6	M	" " "	7.787	117	.90	2.05	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	14	F	" " "	8.912	102.9	1.04	1.95	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	2	.....	Spider, Black..... *Ateles dariensis* (Goldman)	.407	58.0	.....	.75	2.75	19	.....	4.5	6.5	2.0	.....	Infant, Panama
.....	18	M&F	" "	1.926	88.6	.785	1.06	7.65	74.5	.....	11.6	17.3	8.6	.....	Juvenile, Panama
.....	11	F	" "	9.163	108.8	1.28	2.12	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	6	M	" "	8.89	118.4	1.42	2.23	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	133	M&F	Squirrel (Marmoset).. *Leontocebus geoffroyi* (Pucheran)	.191	9.67	.....	.56	1.34	9.33	.....	1.87	3.13	1.16	.....	Infant, Panama
.....	4	F	" "	.340	10.4	.10	.25	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	3	M	" "	.453	11.1	.133	.23	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	19	M&F	" "	.475	11.04	.....	.53	3.02	16.53	.....	2.89	3.91	1.38	.....	Juvenile, Panama
.....	8	M&F	" "	.793	19.9	.....	.63	3.91	25.41	.....	4.24	8.48	1.65	.....	Adult, Panama
.....	8	M	" "	.903	24.00	.11	.30	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
.....	2	M	Sykes..... *Cercopithecus*	4.937	60.7	1.14	.878	29.97	119.6	.....	10.70	21.36	85.16	.....	Maji Moto Camp, Africa
.....	4	M	Vervet..... *Cercopithecus aethiops centralis* (Neumann)	3.955	60.89	.279	.554	32.03	86.23	8.98	15.06	25.01	.....	.....	Maji Moto Camp, Africa

93A	1	F	" "	1.225	50.3	.172	.220	6.56	29.65	.....	7.84	9.98	.....	250	Juvenile, Maji Moto Camp, Africa
.....	4	F	White-face..... *Cebus capucinus linnaeus*	2.718	71.6	.4	1.43	.....	.....	.....	.....	.....	.....	.....	Panama
.....	5	M	" " "	3.833	73.3	.38	1.23	.....	.....	.....	.....	.....	.....	.....	Panama
.....	6	F	" " "	1.252	60.8	.26	.70	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	7	M	" " "	1.725	75.5	.34	.61	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
.....	14	M&F	" " "	3.101	72.18	.....	1.06	18.6	.....	.....	14.3	34.07	11.3	.....	Adult, Panama
.....	6	M&F	" " "	1.317	66	.....	.97	7.53	.....	.....	8.56	20.44	5.7	.....	Juvenile, Panama
.....	27	M&F	" " "	.590	53.28	.....	.568	3.06	.....	.....	4.04	7.93	2.10	.....	Infant, Panama
.....	60	M&F	Yellow Titi..... *Saimiri orstedii orstedii reinhardt*	.607	19.9	.....	.63	3.68	25.6	.....	3.99	7.20	.9	.....	Adult, Panama
.....	3	M	" "	.907	25.3	.15	.447	.....	.....	.....	.....	.....	.....	.....	Panama
.....	2	.....	" "	.167	19.4	.....	.20	.85	7	.....	1.3	2.5	.3	.....	Infant, Panama
.....	2	.....	" "	.24	22	.....	.45	1.25	12	.....	2.5	4.9	.65	.....	Juvenile, Panama
.....	3	F	" "	.603	25	.16	.323	.....	.....	.....	.....	.....	.....	.....	Adult, Panama

ANTHROPOIDS

.....	1	F	Chimpanzee..... *Troglodytes niger*	.....	.....	.....	3.8	.....	.....	.....	.....	.....	.....	.....	Yale Univ. Dept. of Physiology
.....	1	F-P	" "	.....	.....	8.0	8.9	.....	.....	.....	.....	.....	.....	.....	Yale Univ. Dept. of Physiology
215	1	M	" "	25.85	430.5	10.1	5.0	184.6	.....	.....	.....	.....	.....	.....	Emaciated specimen from New York
218A	1	M	" "	56.69	440	4.85	8.93	250	1210	.....	210	600	.....	6200	Budonga Forest, Masindi, Uganda, Africa
219A	1	F	" "	43.99	325	4.55	8.4	219	.....	.....	.....	.....	.....	.....	Budonga Forest, Masindi, Uganda, Africa
.....	1	M	Gorilla..... *Gorilla gorilla*	181.	.....	6 est.	35 est.	.....	.....	.....	.....	.....	.....	.....	American Museum of Nat. History, New York
1291	1	M	Chinese.....	57.2	1248	21.54	10.1	.....	.....	.....	.....	.....	.....	.....	Age: 70 yrs. Australia

ANTHROPOIDS—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
1339	1	M	Chinese	.....	1297	13.3	5.35	.....	.....	.....	.....	.....	.....	.....	Age: ? Hawaii
1338	1	M	"	.....	1268	11.4	9.9	.....	.....	.....	.....	.....	.....	.....	Age: ? Hawaii
1340	1	M	Hawaiian.....	95	1235	16.7	.....	430	.....	.....	.....	.....	.....	.....	Age: 36 to 40, Hawaii
755	1	M	Maya-Quiche Indian	42	1270	35	15	220	1040	.....	185	1315	60	.....	Age: 25. Death from T. B.
757	1	M	" " "	43.4	1375	80	14	210	1270	.....	170	755	80	.....	Age: 35: Death, Septicemia
758	1	M	" " "	49.9	1400	30	10	240	.....	.....	.....	.....	.....	.....	Age: 32. Death, Double pneumonia
1169	1	M	" " "	36.3	1280	11.1	5.6	155	.....	.....	.....	.....	.....	.....	Age: 45. Death, Cachexia
1334	1	M	" " "	45.0	1190	108	10.0	226	.....	.....	.....	.....	.....	.....	Age: 32. Death, Pneumonia
1336	1	M	" " "	37.0	1100	10.0	5.0	159	.....	.....	.....	.....	.....	.....	Age: 17. Death, Cachexia
1335	1	F	" " "	45.8	1000	10.0	10.0	225	.....	.....	.....	.....	.....	.....	Age: 28. Death, Cachexia
1341	1	F	Filipino.....	.....	1109	25.1	.....	200	.....	.....	.....	.....	.....	.....	Age: 39. Hawaii
1337	1	M	"	.....	1513	16.8	9.3	.....	.....	.....	.....	.....	.....	.....	Age 53. Hawaii
751	1	M	Negro, Aborigine.....	76.2	1348	36.5	4.2	.....	.....	.....	.....	.....	.....	.....	Age 66. Australia. Death, Pneumonia
1312	1	M	" American.....	86.2	1265	19.8	16.7	365	1520	.....	.....	.....	.....	.....	Age: 41. American born
1255	1	M	" "	71.2	1280	18.2	11.8	465	1500	.....	.....	.....	.....	.....	Age: 24. American Negro
753 754 4 8	4	M	" "	73.0	1365	31.77	12.69	389	.....	.....	259	.....	.....	.....	Age: ? American

1316	1	M	White, American.....	78.5	1540	37.3	16.4	331	2010	.....	292	.....	.....	.....	Age: 25. Czech descent
1327	1	M	Dane boy.....	36.0	1327	14	11	220	.....	.....	.....	.....	.....	.....	Age:13yrs.Denmark
1333	1	F	Dane woman.....	61	1200	17	13	300	.....	.....	.....	.....	.....	.....	Age:47yrs.Denmark
1332	1	F	" "	46	1160	23	14	260	.....	.....	.....	.....	.....	.....	Age:68yrs.Denmark
1330	1	F	" "	43	1240	14	18	320	.....	.....	.....	.....	.....	.....	Age:65yrs.Denmark
1326	1	F	" "	63	1180	17	14	450	.....	.....	.....	.....	.....	.....	Age:78yrs.Denmark
1324	1	F	" "	43	1350	15	13	220	.....	.....	.....	.....	.....	.....	Age:50yrs.Denmark
1323	1	F	" "	44	1300	10	.....	310	.....	.....	.....	.....	.....	.....	Age:44yrs.Denmark
1322	1	F	" "	45	1140	15	.....	410	.....	.....	.....	.....	.....	.....	Age:60yrs.Denmark
1321	1	M	Dane male.....	51	1500	24	.....	380	.....	.....	.....	.....	.....	.....	Age:55yrs.Denmark
1325	1	M	" "	83	1420	29	.....	520	.....	.....	.....	.....	.....	.....	Age:68yrs.Denmark
1328	1	M	" "	56	1570	47	19	380	.....	.....	.....	.....	.....	.....	Age:28yrs.Denmark
1329	1	M	" "	61	1490	26	17	410	.....	.....	.....	.....	.....	.....	Age:39yrs.Denmark
1331	1	M	" "	51	1310	27	15	290	.....	.....	.....	.....	.....	.....	Age:55yrs.Denmark
1318	1	M	White, American.....	81.6	1350	42.0	12.0	370	1200	.....	320	.....	.....	.....	Age: 22 yrs. German descent
762	1	M	" "	.....	1450	42.63	9.42	330	1500	.....	110	1280	100	.....	Age: ? Irish descent
1311	1	M	" "	79.4	1274	35	12.9	390	1970	.....	.....	.....	.....	.....	Age 54 yrs. Polish descent
1313	1	M	" "	81.6	1130	20.0	16.6	400	1730	.....	.....	.....	.....	.....	Age 54 Yrs. Polish descent
3	1	M	Pole, Immigrant	74.0	1377	23.92	10.94	382	.....	.....	.....	.....	.....	.....	Age: ? Cleveland, O.
759	1	M	White, American.....	50	1480	48.47	14.96	325	1300	.....	330	.....	.....	.....	Age: ? Scotch descent, New York
1215	1	M	" "	65.8	1310	23.6	17.6	340	1780	.....	310	.....	.....	.....	Age: 30 yrs. Swedish descent
1319	1	M	" "	74.8	1410	40	13.8	330	2250	.....	.....	.....	.....	.....	Age: 29 yrs. Ukranian descent
1318	1	M	" "	74.3	1360	47.7	9.4	264	2800	.....	.....	.....	.....	.....	Age: 30 yrs. Ukranian descent
1342	1	F	" "	.....	1300	25.5	.....	300	.....	.....	.....	165	.....	.....	Age: ? Adult American
217	1	F	" "	57	1351	22.9	12.0	340	.....	.....	.....	.....	.....	.....	Age: ? Adult American
223 227 610	3	M	" "	68	1411	23.30	8.46	306	.....	.....	.....	.....	.....	.....	Age: ? Adult American, descent unknown

REPTILES

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
233	1	M	Alligator..... *Alligator mississippiensis*	.105	.....	.35	.40	1.39	.....	.....	.....	.....	.....	.....	Infant
1191 1192	2	M	" "	.351	1.61	.176	.076	1.62	6.99	1.73	1.52	2.97	.211	13.83	Infants, Florida
134	1	F	" "	.....	.....	3.50	4.00	.....	.....	.....	161	.....	.....	.....	Jacksonville, Fla.
628	1	F	" "	52.4	7.23	4.28	6.62	137	708	15.96	.....	393	.....	.....	Great Lakes Expo.
171	1	M	" "	80.0	.....	3 11	12 85	...	....	.....	.....	.....	.....	.....	Cumberland, Ga.
218	1	M	" "	109 est.	8.40	6.90	5.80	92.20	.....	.....	.....	1770	.....	.....	Musa Island, Fla.
71	1	M	" "	173	11.20	8.83	5.40	255	900	30.86	.....	1400	.....	2800	Miami, Fla.
1251	1	M	" "	205	14.08	13.32	11.96	318	522	25.54	.....	628	135	7000	Florida
183	1	F	Crocodile..... *Crocodylus americanus*	90 est.	.....	3.77	4.17	.....	.....	.....	.....	.....	.....	.....	Cumberland, Ga.
186	1	M	" "	134	15.60	5.20	4.30	134	1145	.....	.....	1125	.....	.....	Musa Island, Fla.
670	1	F	Gila Monster..... *Heloderma suspectum*	.514	.729	.152	.056	4.17	35.00	.....	.....	6.45	.....	.....	Arizona
713	1	F	Iguana Lizard..... *Iguana iguana*	1.34	.....	.117	.215	2.60	33.35	.....	.....	3.70	.....	42.6	Guatemala
68	1	F	Iguana Lizard..... *Amblyrhynchus cristatus*	4.19	1.44	.040	.090	21.51	60.40	1.06	11.60	64.4	.....	610	Florida
.....	15	M&F	Lizard..... *Lacerta viridis*	.050	.121	.008	.020	.....	2.50	.....	.58	.....	.080	.....	Europe—data from Naccarati
59	1	F	" "	.026	.134	.005	.004	.091	.628	.144	.21	.....	.....	.....	Africa
679	1	F	Snake, Black..... *Coluber constrictor*	.590	.271	.131	.182	6.08	.....	.....	.....	.....	.....	.....	Little Mountain, O.
1190	1	M	" "	.286	.303	.056	.056	.960	2.57	.219	2.58	3.45	.78	12.02	Laboratory specimen
616	1	F	" "	.417	.299	.114	.103	.....	.....	.165	.....	4.13	.....	.....	Little Mountain, O.
710	1	F	Boa Imperator..... *Boa imperator*	1.829	.440	.15	.15	5.64	30.37	.550	9.57	14.0	.....	.....	Guatemala

668	1	F	Snake, Garter	.052	.077	.....	.....	.....	.....	.....	.....	.....	.....	.....	Willoughby, O.
			Thamnophis sirtalis												
680	1	F-P	" "	.057	.123	.020	.076	1.02	.....	.....	.....	.....	.....	.....	.....
178	1	M	Python	6.140	1.123	1.33	2.68	18.50	.....	1.12	.....	.....	.....	.....	Enguruka, Africa
			Python molurus												
.....	20	M&F	Snake, Water	.070	.1	.01	.035	.....	2.80	.....	.88	.....	.12	.....	Europe—data from Naccarati
			Tropidonotus natrix												
66F	1	F	Water Moccasin	.728	.64	.50	1.06	4.77	64.45	.61	13.47	22.62	5.57	300	Everglades, Fla.
			Agkistrodon piscovoris												
.....	6	M&F	Snake, Green Water	.22	.209	.045	.08	.....	4.82	.....	1.93	.....	.125	.....	Europe; data from Naccarati
			Zamenis viridis flavus												
.....	30	M&F	Turtle	.250	.25	.025	.028	.....	7.3	.....	1.38	.....	.16	.....	Europe; data from Naccarati
			Emys europea												
.....	30	M&F	Turtle	.320	.30	.036	.031	.....	8.5	.....	1.55	.....	.18	.....	Europe; data from Naccarati
			Testudo graeca												
700	1	M	Turtle	2.163	1.36	.125	.413	7.05	53.5	1.35	8.45	31.95	2.25	108.5	Thompson, O.
			Clemmys guttatus												
66A	1	F	Turtle	5.125	.98	.48	.62	13.43	160	.72	24.50	85	.....	.....	Maji Moto Camp, Africa
			Chelydra serpentina												
62F	1	F	Turtle, Green	68.04	5.81	3.46	3.27	180	540	21.08	.....	.....	62.57	.....	Key West, Fla.
			Chelonia midas												
6F	1	M	" "	114.30	8.60	24.55	3.84	435	775	66.20	840	.....	250	8750	Key West, Fla.
1252	1	M	Turtle	.185	.....	.....	.....	.57	.....	.....	.20	4.40	.....	.....	Cleveland, O.
			Clemmys guttatus												
325	1	F	Turtle, Leatherneck	3.253	2.50	.51	.44	16.0	90.0	.....	15	.....	.....	.....	Florida
			Amyda forex												
601	1	M	Turtle, Snapping	1.848	1.01	.59	.51	12.88	184	1.21	15.9	34.90	16.41	.....	Sandusky, O.
			Macrochelys lacertina												

RODENTS

.....	1	.....	Agouti, Brown	1.400	15.00	.....	.5	10	60	.....	14	10	5	.....	Infant, Panama
			Dasyprocta punctata dariensis (Goldman)												
.....	3	M&F	" "	2.059	12	.....	.48	9.2	63.22	.....	10.7	12.89	5.23	.....	Juvenile, Panama
.....	2	M&F	" "	3.172	18.34	.....	.98	17.54	85	.....	15.39	16.0	6.04	.....	Adult, Panama
.....	1	M	Agouti, Spotted	.891	20.5	.101	.40	.....	.....	.....	.....	.....	.....	.....	Juvenile, Panama
			Cuniculus paca virgatus (Bangs)												
.....	2	M&F	" "	1.373	10	.....	1.4	5.5	65.0	.....	10.5	16.5	5.00	.....	Juvenile, Panama

RODENTS—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
.....	3	M&F	Agouti, Spotted	3.627	21.85	.....	1.6	16.10	187	.....	22.7	23.5	12.07	.....	Adult, Panama
.....	1	M	" "	4.559	48	.82	3.1	.....	.....	.....	.....	.....	.....	.....	Adult, Panama
1286	1	M	Beaver *Castor canadensis*	4.18	25.48	.207	.228	16.57	99.82	.....	35.86	63.47	.....	.....	Michigan
1290	1	F	" "	5.83	29.52	.644	.752	27.0	203	1.50	72.60	33.3	4.75	.....	Michigan
.....	2	M&F	Capybara *Hydrochoerus isthimius* (Goldman)	27.670	52.21	.....	5.2	84.13	577	.....	69.75	227	50.58	.....	Adult, Panama
.....	1	.....	" "	7.089	.....	.....	.....	24.18	113	.....	28.06	38.50	16.3	.....	Infant, Panama
.....	3	M&F	" "	14.96	.....	.....	2.72	55.06	509	.....	81.0	88.99	75.3	.....	Juvenile, Panama
33 49	2	F	Chipmunk *Tamias striatus fisheri* (Howell)	.....	1.60	.003	.008	.....	.....	.....	.....	.....	.....	.....	Arizona
703 671	2	M	" "	.075	2.22	.030	.070	.597	5.55	.556	.756	.719	.222	4.65	Cleveland
34 35 38 51	4	M	" "	.....	1.73	.002	.015	.....	.....	.....	.535	.....	.....	.....	Arizona
50 55 57 41 44	5	F	Gopher, Pocket *Thomonys fulvus fulvus* (Woodhouse)	.....	1.33	.0041	.012	.....	.....	.....	1.15	.....	.....	.....	Arizona
53 59	2	M	" "	.....	1.20	.006	.014	.....	.....	.....	.820	.....	.....	.....	Arizona
174 175	2	F	Gopher, Pocket *Geomys cumberlandius* (Bangs)	.....	.....	.013	.021	.....	.....	.....	.....	.....	.....	.....	Arizona

170	2	M	" "	.....	.....	.022	.005	.....	.....	.....	.....	.....	.....	.....		Arizona
173																
775	1	F-P	Guinea Pig..... *Cavia cutleri*	.351	3.63	.070	.375	1.72	10.94	.88	2.79	5.86	.52	.....		Young adult, Cleveland
1132	2	M	" "	.361	4.10	.053	.334	1.27	13.80	.93	3.43	4.62	.71	.....		Young adult, Cleveland
1135																
773	2	F	" "	.324	3.80	.056	.316	1.31	31.93	.95	3.81	3.27	1.08	.....		Young adult, Cleveland
1134																
.....	56	F	" "	.21494	3.32	.036	.180	1.29	12.06	.....	2.829	2.934	.....	.....		Cleveland
.....	46	M	" "	.21457	3.28	.035	.135	1.291	11.73	.....	2.821	2.563	.....	.....		Cleveland
.....	10	F	" "	.432	4.00	.071	.348	1.67	16.7	1.04	3.72	4.63	.925	.....		Cleveland
.....	10	M	" "	.456	4.23	.096	.402	1.86	21.17	.84	4.16	5.12	.750	.....		Cleveland
135	1	F	Hare, African..... *Lepus capensis*	2.93	10.23	.190	.50	30.0	51.91	7.37	12.20	17.91	.....	295		Maji Moto Camp, Africa
248	2	F	Hare, Arctic..... *Lepus arcticus arcticus*	1.901	14.36	.160	.240	28.45	66.11	4.59	19.29	43.79	.....	.....		Tavane, Canada
251																
249	2	M	" " "	2.640	13.90	.099	.191	28.87	65.22	4.75	25.44	44.04	.....	.....		Tavane, Canada
250																
50A																
50C	4	F	Lemming, Brown..... *Lemmus trinucronatus* (Richardson)	.032	1.126	.0058	.0167	.434	2.33	.0230	44.04	.804	.....	.....		Churchill, Canada
50D																
50E																
50B	1	M	" "	.048	1.312	.0046	.0251	.600	3.80	.0242	.525	.740	.....	.....		Churchill, Canada
3																
4	4	M	Lemming, Rock..... *Dicrostonyx rubricatus richardsoni*	.0521	.8983	.0042	.0138	.311	2.63	.1451	.774	.827	.210	.....		Churchill, Canada
10B																
10E																
10A																
10C	3	F-P	" "	.0552	.8447	.0089	.0177	.381	3.05	.062	.841	.884	.....	.....		Churchill, Canada
10D																
171	1	M	Mouse, African..... *Mastomys coucha microdon*	.0218	.7132	.001	.0095	.122	.944	.075	.265	.2408	.....	2.63		Maji Moto Camp, Africa
674																
630B	3	F	*Mouse, Jumping..... *Zapus hudsonicus*	.0193	.6961	.001	.008	.1557	1.124	.028	.218	.246	.0261	.....		Little Mountain, O.
630C																
630A	1	M	" "	.0152	.522	.003	.005	.133	.743	.025	.266	.243	.....	.....		Little Mountain, O.
1A	1	F-P	Mouse, Dormouse..... *Claviglis saturatus* (Dollman)	.0223	.705	.004	.002	.1132	.851	.063	.192	.205	.....	.....		Maji Moto Camp, Africa

RODENTS—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
145	1	M	Mouse, Dormouse	.0177	.551	.006	.0042	.116	.308	.052	.091	.272	.....	.75	Maji Moto Camp, Africa
66, 68	2	M	Mouse, Grasshopper *Onychomys*	.....	.....	.0011	.0237	.....	.....	.....	.374	.....	.....	.....	Seligman, Arizona
69	1	F	" "	.....	.....	.0014	.040	.....	.....	.....	.392	.....	.....	.....	Arizona
.....	67	M	*Mouse, Meadow *Microtus drummondi*	.0237	.6606	.0032	.0085	.1612	1.082	0239	.3634	.4036	.....	.....	Churchill, Canada
.....	42	F	" "	.0229	.6464	.0031	.0160	.1609	1.129	.0236	.3814	.3930	.....	.....	Churchill, Canada
.....	4	F-P	" "	.0325	.6724	.0037	.0366	.1999	1.754	.0276	.5357	.5575	.....	.....	Churchill, Canada
.....	42	F	*Mouse, Meadow *Microtus pennsylvanicus pennsylvanicus*	.0252	.7166	.0046	.0164	.1973	1.349	.0269	.3103	.3916	.....	.....	Willoughby, O.
.....	53	M	" "	.0279	.7394	.0042	.0071	.1937	1.312	.0254	.3126	.3984	.....	.....	Willoughby, O.
.....	10	F-P	" "	.0413	.7635	.0065	.0305	.2574	2.250	.0277	.4821	.4999	.....	.....	Cleveland, O.
7, 11, 12	3	F	Mouse, Mountain Meadow *Microtus alticola alticola*	.....	.....	.0018	.0063	.....	.....	.....	.233	.....	.....	.....	Arizona
13	1	M	" " "	.....	.....	.0032	.0126	.....	.....	.....	.....	.....	.....	.....	Arizona
.....	14	M	*Mouse, Guatemala *Peromyscus*	.0122	.407	.0014	.0037	.0983	.65	.0235	.1477	.22	.....	.....	Guatemala
.....	2	F	" "	.0184	.4511	.0021	.0049	.1132	1.243	.033	.2157	.303	.....	.....	Guatemala
.....	8	F-P	" "	.0200	.443	.0024	.0064	.1499	1.186	.0291	.2255	.334	.....	.....	Guatemala
9	1	M	Muskrat *Ondatra zibethica alba*	.900	5.33	.0133	1.43	3.23	21.95	.188	7.45	4.35	.....	176	Churchill, Canada
21A	1	F	Porcupine *Erithizon dorsatum*	2.800	30.77	.72	.62	19.75	112.	2.88	26.97	29.88	.....	.....	Maji Moto Camp, Africa
234, 289	2	F	" "	2.725	21.22	.361	.337	14.4	.....	.....	.....	.....	.....	.....	Animal Dealer, New York

*Preserved weights.

324	1	M	Porcupine	3.410	19.15	.341	.355	15.5	108	.....	38	27.1	.....	.....	Animal Dealer, New York
81	1	F	Prairie Dog..... *Cynomys gunnissoni zuniensis* (Hollister)	.....	.....	.034	.019	.....	.....	.....	2.72	.....	.....	.....	Seligman, Arizona
84	1	M	" "	.....	5.60	.025	.028	.....	.....	.....	2.564	.....	.....	.....	Seligman, Arizona
93, 94	2	F	Rabbits, Cottontail... *Silvilagus auduboni*	.....	.....	.047	.071	.....	.....	.....	6.123	.....	.....	.....	Florence, Arizona
97, 105	2	M	" "	.....	7.25	.031	.094	.....	.....	.....	5.14	.....	.....	.....	Catalina Mts., Arizona
323, 603	2	M	Rabbits, Flemish giant *Lepus*	3.68	10.59	.685	.503	10.57	97.9	.....	24.01	.....	.....	.....	Cleveland
.....	22	F	" " "	2.587	10.14	.403	.662	9.23	82.63	.....	18.3	13.72	.....	.....	Cleveland
80	1	F	Rabb't, Jack..... *Lepus californicus*	.....	12.00	.147	.256	.....	.....	.....	19.34	.....	.....	.....	Seligman, Arizona
.....	2	.....	Rabbits, Wild..... *Silvilagus gabbi messorius* (Goldman)	.439	4.50	.....	.750	2.00	19.50	.....	3.50	4.50	.75	.....	Adult, Panama
16, 45, 62	2	M	Rat, Mexican pack.... *Neotoma*	.....	2.20	.009	.078	.....	.....	.....	2.56	.....	.....	.....	San Francisco Crater, Arizona
73, 74, 47	4	F	"	.....	1.87	.014	.056	.....	.....	.....	2.19	.....	.....	.....	San Francisco Crater, Arizona
235	1	F	Rat, Norway..... *Mus norvegicus*	.197	1.61	.008	.062	.730	.....	.....	.....	1.41	.....	.....	Cleveland
701, 704	2	M	" "	.278	2.30	.032	.149	1.61	9.31	.296	3.03	2.29	.82	7.02	Cleveland
.....	5	M	Shik-shik..... *Citellus paryii paryii* (Richardson)	.878	5.63	.105	.228	5.85	36.27	1.77	7.16	9.87	2.12	.....	Churchill, Canada
.....	3	F	" "	.958	5.74	.116	.208	5.92	44.83	1.73	7.12	10.57	1.14	.....	Churchill, Canada
64, 63, 22, 18	4	M	Squirrels, Abert..... *Sciurus aberti*	.....	6.25	.030	.204	.....	.....	.....	3.12	.....	.....	.....	San Francisco Crater, Arizona
.....	1	.....	Squirrel..... *Sciurus gerrardi morulus* (Bangs)	.287	.....	.....	.300	2.00	11.00	.....	3.00	3.80	.60	.....	Adult, Panama
48	1	M	Squirrel, Ground..... *Callospermophilus*	.....	3.00	.010	.035	.....	.....	.....	.141	.....	.....	.....	Shultz Pass, Arizona

RODENTS—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
78	1	M	Squirrel, Ground..... *Citellus tridecemlineatus*	.....	2.00	.004	.019	.....	.....	.....	1.09	.....	.....	.....	Seligman, Arizona
23C 23F 23G 23H	4	F	Squirrel, Red..... *Sciurus hudsonicus*	.248	5.02	.029	.075	1.82	6.64	.534	1.32	3.17	.....	.....	Churchill, Canada
23A 23B 23D 23E	4	M	" "	.183	4.71	.023	.049	1.57	3.99	.497	1.14	2.66	.....	.....	Churchill, Canada
633B 633D	2	F	Squirrel, Red..... *Sciurus hudsonicus loquax*	.169	4.21	.031	.098	1.23	5.88	.661	1.51	1.34	.....	.....	Cleveland
633A	1	M	" "	.183	3.97	.006	.082	1.511	4.18	.390	1.425	3.25	.....	.....	Cleveland
633C	1	M	" "	.063	4.09	.0056	.025	.545	1.74	.436	.615	1.54	.....	.....	Juvenile, Cleveland
17 19 23 26 31 32 60	7	F	Squirrel, Red..... *Sciurus fremonti mogollonensis*	.....	4.30	.009	.079	.....	.....	.....	1.74	.....	.....	.....	San Francisco Crater and Shultz Pass, Arizona
20 21 25 27 28 29 61	7	M	" "	.....	4.40	.013	.095	.....	.....	.....	1.74	.....	.....	.....	.....

677	1	M	Bison, American. *Bison bison*	54.88	334	5.47	6.64	361	695	42.68	256	1190	146	.....	Calf, Zoo, Cleveland, O.
79A 80A	2	M	Buffalo *Syncerus caffer caffer*	750 est.	640 est.	34.96	31.05	.....	.....	.....	.....	.....	.....	.....	Maji Moto Camp, Africa
45A	1	F-P	" " "	572	642	37.30	43.27	3050	7175	69.94	1625	5150	2304	146000	Maji Moto Camp, Africa
71A	1	M	" " "	759	653	38.05	52.40	3620	7709	55.00	1825	8110	.....	150000	Maji Moto Camp, Africa
614	1	F	Bushbuck *Tragelaphus scriptus massaicus*	35.38	140	6.76	4.43	325	625	40.53	131	915	92.75	.....	Africa
94A	1	M	" "	53.07	190	5.08	5.09	350	1100	.....	225	540	.....	6700	Lake Manyara, Africa
652	1	F	Caribou, Barren ground *Rangifer arcticus arcticus*	71.7	278	3.99	2.29	710	466	33.35	82.77	1275	131	.....	.....
44 653	2	M	" "	128.47	306	8.37	5.99	1086	2445	41.66	151	2450	310	25400	Tavane and Churchill, Canada
42	1	M	" "	62.14	285	5.98	4.16	650	.....	.....	.....	.....	.....	.....	Chesterfield Inlet, Canada
.....	1	F	Aberdeen angus	719	.....	57.5	57.50	1950	6690	.....	1746	2654	839	21682	.....
		D	ata from Journal of Agri	cultura	l Resea	rch V.	55, N	o. 4, A	ugust	15, 193	7. W	. W. S	wett a	nd As	sociates.
.....	44	F	Ayrshires	491	417	33.4	31.2	1882	6010	.....	1148	3311	817	25156	.....
.....	5	F	Cows	.....	.....	11.82	18.07	.....	.....	.....	.....	.....	.....	.....	Florida
.....	6	F	Cows	.....	.....	21.03	24.01	.....	.....	.....	.....	.....	.....	.....	Cleveland
.....	62	F	Guernseys	450	403	31.6	27.7	1737	6087	.....	978	3143	832	23523	.....
.....	7	F	Herefords	371	357	15.24	18.46	1143	3819	.....	672	2272	561	20734	.....
.....	200	F	Holsteins	574	415	38.1	37.7	2245	7248	.....	1445	4336	946	29184	.....
.....	6	M	Holstein bulls	90	299	14.25	6.37	422	.....	.....	.....	.....	.....	.....	Under 6 mos. old
.....	3	M	Holstein bulls	241	386	30.2	10.13	998	.....	.....	.....	.....	.....	.....	6 to 12 mos. old
.....	5	M	Holstein bulls	552	408	41.4	19.76	1905	.....	.....	.....	.....	.....	.....	1 to 3 yrs. old
.....	2	M	Holstein bulls	861	471	45.5	22.5	3243	.....	.....	.....	.....	.....	.....	3 to 5 yrs. old
.....	5	M	Holstein bulls	888	462	95.34	41.6	3357	.....	.....	.....	.....	.....	.....	Over 5 yrs.
.....	218	F	Jerseys	413	408	27.9	27.4	1605	5747	.....	983	3057	801	22230	.....
.....	3	M	Jersey bulls	51.9	304	6.4	5.35	304	.....	.....	.....	.....	.....	.....	Under 6 mos. old

UNGULATES—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
..	5	M	Jersey bulls	214	356	19 38	9 78	744	..	..	..	..	..	..	6 to 12 mos. old
..	2	M	Jersey bulls	367	384	29.05	14 5	1270	..	..	..	..	..	..	1 to 3 yrs. old
..	2	M	Jersey bulls	591	444	47 00	18 3	1987	..	..	..	..	..	..	3 to 5 yrs. old
..	10	M	Jersey bulls	597	447	82 20	27 45	2186	..	..	..	..	..	..	Over 5 yrs. old
..	213	M	Jersey bulls	412	408	27.90	27.40	1606	..	..	..	..	..	..	Av. 8 yrs. 2 mos.
..	71	F	Miscellaneous cows	506	420	35.2	303 3	1888	6786	..	1207	3978	812	..	.....
..	6	M	Steers	.....	.....	18.8	20.68	.....	.....	.....	.....	.....	.....	.....	Cleveland
..	15	M	Steers	174	.....	13.9	16.57	.....	.....	.....	.....	.....	.....	.....	Florida
.....	18	M	Steers	369	384	20.87	13.16	1533	.....	.....	423	.....	.....	11.1	U. S. D. A.
1390	1	M	Calf	.....	203.6	4.7	5.2	234.5	505.2	32.6	89.6	294.2	52.9	.....	Full term foetus, Lexington, Ky.
1388	1	.....	Calf	19.5	193.9	8.0	29.4	232	220.5	29.4	106.0	473.2	80.5	.....	Three days old, Lexington, Ky.
1386	1	.....	Calf	233.6	187.9	6.9	4.8	174.2	535.8	25.9	117.4	519.6	69.5	.....	Crossbred, Lexington, Ky.
1389	1	.....	Calf	22.0	215.2	19	32.5	265.3	1008.8	28.7	167.2	737.1	69.1	.....	Six days old, Lexington, Ky.
1387	1	.....	Calf	.....	234.6	12.6	3.0	315.3	792.3	14.3	156.4	581.1	103.5	.....	Lexington, Ky.
1391	1	F	Cow	489.9	473.5	46.1	17.4	2601	6265	69.6	1105.8	6359	729.9	.....	Lexington, Ky.
.....	2	.....	Deer	2.376	54.1	.2	.62	5.16	72	.....	16.5	44.3	5.0	.....	Juvenile, Panama
			Odocoileus chiriquensis (Allen)												
.....	1	F	" "	13.93	.....	.....	3.0	15.9	516	.....	55	520	35	.....	Adult, Panama
124	1	M	Deer, Axis	.....	.....	20	8.6	.....	.....	.....	280	.....	.....	.....	India
			Cervus axis												
644	1	M	" "	88.45	219	17.5	6.45	749	1730	34.4	247	1726	223	.....	Zoo specimen, Cleveland
277	1	M	Deer, Malay Sambar	148	.....	25	30.6	.....	.....	.....	317	.....	.....	.....	.....
			Cervus unicolor												
184															
181	3	M	Deer, White-tailed	.....	.....	28.3	23.35	.....	.....	.....	.....	.....	.....	.....	Cumberland Island, Ga.
182			*Odocoileus virginianus*												

172, 177	2	F	Dear White-tailed	.....	.....	21.25	23.05	.....	.....	.....	.....	.....	.....	.....	Cumberland Island, Ga.
272	1	M	" "	65.09	210	5.1	12.25	632	1025	.....	.....	1318	.....	.....	Virginia
.....	3	M	Deer, White-tailed.... *Odocoileus couesi*	.....	123	2.57	.305	.....	.....	.....	123	.....	.....	.....	Kaibab Forest, Arizona
85, 86, 88	3	M	Deer, Mule..... *Hemionus odocoileus*	.....	182	2.86	5.48	.....	.....	.....	203	.....	.....	.....	Kaibab Forest, Arizona
87	1	F	" "	.....	.....	2.30	5.25	.....	.....	.....	250	.....	.....	.....	Arizona
27A	1	M	Dik-dik..... *Rhynchotragus kirki*	4.57	37	.73	.56	36.8	93.2	.....	21.4	44.4	.....	.....	Maji Moto Camp, Africa
568	1	M	Elk..... *Cervus canadensis*	13.61	194.2	6.14	2.38	131.1	374	.....	73.4	319	.....	.....	Zoo specimen, Cleveland
136	1	F	" "	.....	.....	9.5	8.85	.....	.....	.....	365	.....	.....	.....	Zoo specimen, Cleveland
24, 54	2	M	Gazelle, Thomson..... *Gazella thomsoni*	24.37	91.8	1.83	2.0	245	525	26.6	105	280	.....	.....	Maji Moto Camp, Africa
89	1	F	" "	2.430	54.61	.46	1.04	31.7	60.61	12.35	16.5	74.4	.....	380	Infant, Africa
68A	1	M	Giraffe..... *Giraffa camelopardalis tippelskirchi*	1220	700	64.70	78.12	4990	19050	127	2268	12060	2266	130000	Africa, Maji Moto Camp
1259	1	M	Goat..... *Capra hirous*	27.66	115	.....	.....	.....	525	29.55	.....	.....	.....	1466	Cleveland, O.
53	1	M	Hartebeest, Coke's.... *Bublis cokei cokei*	134	275	1.83	9.61	875	1525	56.36	387	1850	625	14540	Moto Umbo, Africa
142A	1	F	Hippopotamus..... *Hippopotamus amphibius*	543	540	32	53.35	1610	14060	35.02	1175	4910	.....	83000	Juvenile, Maji Moto Camp, Africa
143	1	F	" "	1351	720	119	61.10	4536	23580	42.70	3160	11340	3175	374000	Adult, Maji Moto Camp, Africa
.....	53*	M	Hogs..... *Sus scrofa*	102.06	.....	6.88	4.99	303.5	1488.3	.....	237.83	.....	117.74	1817	Average age, 236 days. Standard bred castrates
.....	36*	F	" "	102.06	.....	7.52	4.99	324.39	1547.3	.....	264.09	.....	138.64	1988.07	Age 241 days. Standard bred young sows
.....	30*	.....	" "	102.06	.....	6.46	5.44	297.5	1389.5	.....	246.45	.....	121.71	1667.7	F^2 crossbred, average 252 days

*Data furnished by the Bureau Animal Industry, U. S. Department of Agriculture.

UNGULATES—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
176	2	F	Hogs, wild	.....	.....	8.42	2.71	.....	.....	.....	.....	.....	.....	.....	Florida
178			*Sus scrofa*												
179	2	M	" "	.....	5.31	.....	2.69	.....	.....	.....	.....	.....	.....	.....	Florida
180															
192															
193															
194	5	.....	Hogs, domestic	.....	105	14.25	4.16	.....	.....	.....	229	.....	.....	.....	Cleveland, O.
195			*Sus scrofa*												
196															
129	2	F	" "	.....	.....	16.7	3.05	.....	.....	.....	232	.....	.....	.....	Cleveland, O.
130															
1377															
1378															
1379	5	M&F	Pigs, full term foetuses	1.419	30.3	.45	.27	14.25	43.0	3.29	10.47	25.66	1.96	.....	Lexington, Ky.
1380															
1381															
1383	1	M	Pig, shoat	4.76	51.2	.7	.37	52.1	184.6	4.05	16.4	49.35	12.5	.....	Lexington, Ky.
1382	1	F	Pig, shoat	13.15	86.2	.....	1.75	124.5	392.5	5.1	33.7	205.9	29.0	.....	Lexington, Ky.
1384	1	M	Pig, shoat	.....	.....	5.6	2.65	147.3	903.8	6.2	65.4	679.1	34.9	.....	Lexington, Ky.
1419	1	M	Pig, shoat	7.60	54	1.6	2.0	46	284	7.0	54.0	128	14.0	.....	Lexington, Ky.
			Sus scrofa												
1385	1	F	Pig	113.2	123.9	10.8	7.8	452	2334.8	7.3	197.5	299.9	173.3	.....	Lexington, Ky.
3	2	M	Impala	37.86	149	5.67	3.82	270.05	605	44	162.5	510	210	5800	Maji Moto Camp, Africa
161			*Aepyceros melanus*												
13	2	M	" "	57.61	175	5.04	5.36	378	855	47.12	225	730	.....	.....	Africa, Maji Moto Camp
2															
198	1	F-P	" "	.....	.....	5.67	4.62	.....	.....	.....	.....	.....	.....	.....	Africa, Maji Moto Camp

699	1	M	Peccary, Collared..... *Pecari angulatus bangsi* (Goldman)	29	123.5	125	2.95	174	772	10.2	153	279	65.5	.....	Zoo specimen (goiter)
.....	2	.....	" "	13.83	.....	.....	4.5	70.5	371	.....	51.5	120	91	.....	Adult, Panama
.....	1	.....	" "	2.25	.....	.....	2.0	20	60	.....	22	72	10	.....	Infant, Panama
109	1	M	Peccary..... *Pecari angulatus sonoriensis*	.....	82	1.2	1.8	.....	.....	.....	60	.....	.....	.....	Arizona
32	2	M	Reed Buck (Bohor).... *Redunca redunca tohi*	31.7	109	1.34	2.11	242	523	33.4	102	462	.....	.....	Lake Manyara, Africa
33															
.....	9	M	Sheep (Lambs)..... *Ovis aries*	40.23	109	10.11	2.22	168	.....	.....	97.06	.....	.....	2500	Bureau of Animal Industry
187															
188															
189	5	F	" "	.....	88.8	13.3	2.02	.....	.....	.....	93.1	150	.....	.....	Adult, Cleveland, O.
190															
191															
1397	2	.....	Sheep..... *Ovis aries*	2.720	53.8	5.2	3.85	28.30	78.0	13.50	25.8	51.10	10.0	.....	Foetus, 2 to 4 weeks premature. Lexington, Ky.
1398															
1395															
1399															
1401															
1403	8	M	Lambs.....	6.87	73.6	5.19	6.78	82.13	224.5	18.30	55.8	191.5	17.41	.....	About one mo. old. Lexington, Ky.
1404															
1405															
1407															
1420															
1394															
1396															
1408	5	F	"	8.55	71.5	4.09	6.36	85.0	287.2	13.7	69.5	180.5	27.0	.....	About one mo. old. Lexington, Ky.
1421															
1424															
1409															
1422	4	M	"	15.76	88.6	2.0	3.0	158.7	531.8	17.6	108.3	543.5	36.2	.....	Lexington, Ky.
1423															
1427															

UNGULATES—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
1392 1393 1400 1402 1406 1425 1426	7	F	Lambs	52.1	106.5	10.2	8.3	276.7	957	30.49	159.8	704.8	119.6	.....	Lexington, Ky.
25 141	2	M	Steinbok *Raphicerus campestris neumanni*	8.62	49.5	1.22	1.35	72.2	175	14.87	38.51	150	.....	550	Africa, Maji Moto Camp
58	1	M	Warthog *Phacochoerus aethiopicus*	65.32	125	3.6	8.24	325	1500	17.91	300	550	.....	9550	Africa, Maji Moto Camp

UNGULATES—ODD TOED

786 789 790	3	F	Thoroughbred foetus *Equus caballus*	13.00	183.3	4.18	2.21	111.3	702	.....	99	444.3	82.5	.....	Average, 91 days, premature. Ky.
.....	5	F	" "	26.47	254.4	13.23	14.89	331.5	902.2	37.14	245.0	895.7	139.9	.....	Average, 46.4 days, premature. Ky.
.....	5	M	" "	27.30	273.9	12.28	4.66	275.9	699.5	51.48	257.4	1374.	162.5	.....	Average, 54.4 days, premature. Ky.
.....	11	F	" "	47.68	333.9	17.54	8.10	472.	1634.	42.82	321.3	1526.	335.1	.....	Average, 14.6 days, premature. Ky.
.....	15	M	" foetus.....	38.91	317.3	14.80	6.26	458.2	1266.	45.95	275.6	1179.	235.8	.....	Average, 16 days, premature. Ky.
.....	19	F	" foal.....	54.32	366.5	16.80	10.38	606.4	1651.	54.80	405.7	1414.	306.6	.....	Average, 5.6 days old. Kentucky

.....	18	M	" "	52.45	370.1	17.57	9.34	565.	1592.	48.5	323.5	1366.	319.	.....	Average, 3.1 days old. Kentucky
1234 1241 815	3	M	" "	93.89	425.3	15.23	14.43	970.	3386.	56.8	859.3	1427.	610.3	.....	Average, 33.5 days old. Kentucky
1236 1244 1246	4	F	" "	116.77	470.2	22.6	15.20	1125.	3704.	67.5	812.2	2393.	838.5	.....	Average, 83 days old. Kentucky
.....	8	M	" colts.....	285.13	582.8	26.55	18.77	1999.7	8193.	71.09	767.7	299.6	1700	.....	Average, 9 months old. Kentucky
1231 1349	2	F	" fillys.....	380.11	616.	36.9	32.3	2653.	3452.	81.5	1168.	2969.5	3379.	.....	Average, 12 mos. old. Kentucky
.....	5	M	" colts.....	306.35	602.4	26.81	22.2	2708.	4821.	79.05	970.2	3110.	5494.	.....	Yearling colts. Kentucky
.....	6	M	" geldings.....	443.87	637.6	29.41	32.43	3295.	5257.	95.46	1314.	3738.	3845.	.....	Average, 2 to 3 yrs. old. Kentucky
1224 666 1351	3	M	" colts.....	433.92	621.4	26.50	27.71	3488.	3931.	89.90	1297.	3659.	4190.	.....	Average, 2 to 3 yrs. old. Kentucky
.....	7	F	" fillys.....	408.5	632.	30.56	38.41	3237.	5350.	98.82	1653.	4588.	3438.	.....	Average, 2 to 3 yrs. old. Kentucky
638 1250 1247 1300	4	M	" geldings.....	446.55	630.	26.99	33.40	3531.	5193.	96.63	1350.	4092.	4830.	.....	Average, 6.75 yrs. old. Kentucky
.....	5	M	" stallions.....	485.31	706.7	32.15	33.03	4688.	5685.	106.34	1971.7	7154.	3474.	.....	Average, 17.2 yrs. old. Kentucky
.....	10	F	" mares.....	443.36	637.7	29.76	43.5	3663.	6176.	105.0	1667.	4758.	3856.	.....	Average, 19.1 yrs. old. Kentucky
684	1	M	Arabian stallion.....	461.76	618.	46.80	26.80	3909.	6375.	112.24	1512.	5080.	3000.	.....	27 yrs. old. Portsmouth, O.
1287	1	M	" "	362.80	573.	34.95	42.17	3275.	4670.	108.08	1108.	6475.	1900.	.....	30 yrs. old. Portsmouth, O.
1221	1	F	" mare.....	.....	711.4	80.00	.....	3230.	.....	107.8	.....	.....	.....	.....	Nashville, Tenn.
1308	1	M	Burro gelding.....	199.58	392.	13.43	24.2	1184.	3770.	.....	844.	1462.	507.	.....	25 yrs. old. Kentucky
707 711	2	M	Burro.....	122.98	478.	4.80	16.64	850.	1953.	84.31	813.	1320.	280.	.....	Average, 4 yrs. old. Guatemala
1242	1	M	Grade Draft.....	70.76	248.	11.2	7.9	546.	1197.	40.0	230.	916.	524.	.....	Foal, Kentucky
659 660	2	F	Grade Pony.....	184.16	525	10.49	12.98	1175.	2100.	67.47	420.	1348.	458.	.....	1 year old. Kentucky

UNGULATES—ODD TOED—*Continued*

Catalogue Number	No. of Animals	Sex	Common and Scientific Name	Body Weight in Kilograms	Brain	Thyroid	Adrenal	Heart	Liver	Eyes	Kidney	Lung	Spleen	Stomach and Intestines	Remarks
664	1	F	Grade Horse	521.64	655.	24.30	52.51	3260.	6920.	105.92	1510.	4125.	1870.	.....	12 years old. Kentucky
1317	1	M	Hackney Pony	362.87	504.	29.6	21.2	1427.	.....	.....	.....	.....	.....	.....	Urbana, Ill.
.....	10	M	Horses, Panama	279	452	10.77	25.75	.....	.....	.....	.....	.....	.....	.....	Average 12 years. Panama gelding workhorses
.....	31	F	" "	262	468	12.77	25.62	.....	.....	.....	.....	.....	.....	.....	Average 14 years. Panama mares
.....	21	M&F	" "	230.9	520	.....	35.45	1843	4277	.....	942	3627	940	13542	Panama
.....	3	M	Mules, Panama *Equus asinus*	211	371	8.66	24.6	.....	.....	.....	.....	.....	.....	.....	Average 13.3 years. Panama
.....	4	F	" "	291	478	9.75	35.5	.....	.....	.....	.....	.....	.....	.....	Average, 20 years. Panama
.....	1	M	" "	42.64	227	.....	.....	397	1191	.....	227	628	283	1219	Panama colt
.....	4	M&F	" "	279.2	.....	.....	42.53	2048	3594	.....	513	4026	766	13396	Panama
792	1	F	Mule	249.47	543.	11.3	47.	2144.	6301.	.....	1049.	.....	802.	.....	1 year old. Kentucky
1297	1	F	"	444.52	543.	18.98	45.1	3604.	5342.	124.0	964.	5678.	1802.	.....	25 years old. Kentucky
690	1	M	Percheron Stallion	635.04	662.	40.84	39.22	5600.	8520.	136.7	1700.	5710.	3430.	.....	14 years old. Ohio
691	1	F	Percheron Mare	771.40	650.	56.55	37.40	4700.	6725.	137.4	1750.	5400.	1550.	.....	23 years old. Ohio
635	1	F	Polo Pony	380.75	692.	52.10	24.23	3570.	4835.	115.92	950.	8616.	1250.	.....	25 years old. Ohio
1307	1	F	Pony	376.48	604.	20.02	28.00	2607.	5012.	96.5	1894.	2558.	3846.	.....	18 years old. Kentucky
791	1	F	Saddle-bred foetus	19.50	226.	7.2	2.6	181.5	913.	.....	.....	1038.	141.	.....	71 days premature. Kentucky
1245	1	F	Saddle-bred foal	118.8	475.	12.8	10.2	894.	2796.	56.0	735.	.....	536.	.....	3 months old. Kentucky
1296	1	F	" weanling	181.4	492.	.....	.....	1418.	.....	64.0	.....	2981.	.....	.....	6–7 months old. Kentucky

800 1293	2	M	Sabble-bred colts.....	300.5	588.	18.43	17.33	1658.	4397.	87.55	1033.	3457.	1079.	.....	1 year old. Kentucky
1239 1305	2	M	" geldings...	335.68	569.	16.95	20.70	2199.	4616.	84.48	929.	3189.	2010.	.....	1 year old. Kentucky
1348	1	M	Shetland Pony gelding	242.67	560.	15.25	23.5	2195.	3975.	104.0	870.	3740.	1380.	.....	29 years old. Kentucky
803	1	F	Standard bred foetus..	31.75	242.	11.9	6.7	402.	1052.	.....	196.	921.	84.	.....	About 60 days premature. Kentucky
1240	1	M	Standard bred foal....	92.98	400.	14.6	10.1	971.	2400.	69.0	624.	1489.	330.	.....	3 months old. Kentucky
636	1	F	Hunter(Thoroughbred)	402.65	690.	24.45	47.32	3648.	5220.	112.6	1200.	10,120.	1760.	28,110.	15 years old. Ohio
693	1	M	Western gelding.....	426.38	562.	25.59	35.37	3487.	5338.	107.0	1196.	4005.	5750.	.....	23 years old. Ohio
8A	1	M	Rhinoceros..... *Rhinocerus bicornis*	763	655	53.05	88.0	4800.	14310	22.56	3000	7350	.....	.....	Maji Moto Camp, Africa
.....	1	.....	Tapir..... *Tapirella bairdii* (Gill)	8.60	.....	.....	2.0	74	220	.....	92	162	84.	.....	Juvenile, Panama
.....	1	.....	" "	14.26	85	.....	3.0	121	483	.....	167	318	172	.....	Adult, Panama
686	1	M	Zebra..... *Equus quagga granti*	29.48	.....	14.77	6.24	330	937	39.5	90.54	655	135.8	.....	Foetus, Zoo
35A	1	M	" " "	7.900	125	3.04	1.43	75	275	.....	53.65	300	.....	.....	Embryo, Africa
634	1	F	" " "	43.09	412	29.2	9.6	581.8	1275	.....	166.4	740	156.1	.....	Infant, Zoo
179A	1	F	" " "	56.59	410	10	4.95	515	950	.....	262	1025	605	.....	Six weeks old, Africa
626	1	M	" " "	78.02	494.4	48.6	11.5	660.4	.....	.....	357.3	.....	.....	.....	Zoo
20A 160A	2	M	" " "	254.99	541	20.08	23.08	1925	4037	94	855	2025	1170	.....	Stallion, Africa
162A	1	F-P	" " "	297.1	555	17.34	27.8	1970	4400	89	900	2790	.....	.....	Africa
698	1	M	" " "	317.5	642	36.0	44.1	2231	6336	103	1239	.....	1121	.....	Jungle-bred Stallion six yrs. old. Zoo

PROBOSCIDEA AND HYRACOIDEA

148A	1	M	Elephant..... *Loxodonta africana knochenhaueri*	6654	5712	860	940	26080	107670	116.15	18180	138790	.....	924000	Maji Moto Camp, Africa
.....	1	F	Elephant, Pygmy..... *Loxodonta cyclotis*	.....	.....	.....	84	.....	.....	.....	5200	.....	.....	.....	Zoo
149A	1	M	Hyrax..... *Heterohyrax brucei*	.750	12.27	.081	.161	3.63	31.53	.....	6.45	5.532	.....	255	Lake Manyara, Africa

BOOK NOTICES

The Biology of Man

Two facts have become increasingly apparent to teachers of college biology in recent years; first, many modern college students are better equipped in biological courses upon entering college than were students in former days, and second, college students show far greater interest in the biology of human beings than in that of lower organisms. These facts lead to important problems for the college teacher. He must see that the introductory college course reaches a higher level than that of the high school, so as not to dull the students' interest by needless repetition. He must fit into the college course more complex and advanced material, and at the same time keep or even increase the interest of the student.

Dr. Baitsell has taken a noteworthy step in this direction by preparing an excellent introduction to biology, built around the organization and activities of human protoplasm. While the interest of the student is kept up by the human approach, comparative biology is not neglected. It is introduced where and when needed, however, and is not forced upon the student. The book is beautifully written, clearly presented, and well illustrated. It deserves a thorough trial in the introductory course, and should meet with marked success. Especially valuable are the excellent summarizing chapters such as that on The Web of Life, and the unique appendix, which is full of material which the better student will read avidly.

Two adverse comments may be made. The beginning student, it is feared, will develop a teleological viewpoint from the reading of the book unless the teacher is careful to circumvent it. The references to figures are always placed at the ends of the paragraphs dealing with such material, although the concluding sentence of the paragraph frequently has no bearing on the figure.—*L. H. S.*

Human Biology, by George A. Baitsell. xv+621 pp. New York, the McGraw-Hill Book Co. 1940. $3.75.

"Adventures"

The experiences of the scientist certainly may be described as adventures, not in the sense of mere thrills but as journeys into the unknown from which he may return with great treasure or seemingly empty handed. In exploring the mysteries of physiology, Haldane has not hesitated to use himself as an experimental animal; breathing carbon dioxide or taking ammonium chloride to test the effects upon the pH of the blood; sitting in a pressure tank in which conditions in a sunken submarine were reproduced in order to be able to give accurate evidence in court. These are but a few of the "adventures" which the author recounts.

The book is composed of a series of essays, lectures and radio addresses upon such topics as: Unsolved Problems of Weather, Earth, Sun, Life, Race, Health; What Is Life?; What Is Death?; Keeping Cool; Darwin; Protoplasm; Human Biology and Politics; Why I Am a Materialist; Religious Liberty; The Marxist Philosophy; etc. These were written at different times, hence there is a decided lack of unity which there is no attempt to disguise. Rather than a defect, this discontinuity is of advantage to the reader, for the book may be picked up and a single chapter read now, another one later, without danger of losing the thread of the narrative.

Haldane summarizes our scientific knowledge in particular fields and unhesitatingly predicts the state of knowledge thirty or fifty years hence. More than this, he does not recoil from stepping into the fields of politics and philosophy to render his opinions.

The chapters dealing with scientific topics are usually packed with interest whereas a departure into politics and Marxian philosophy in the latter chapters of the book tend to "let one down."

The reader may not agree with the writer's course of action in politics nor the philosophy endorsed, but cannot refrain from admiring such a courageous character.—*P. E. Schaefer.*

Adventures of a Biologist, by J. B. S. Haldane. 281 pages. New York, Harper and Brothers. 1940. $2.75.

LIMNOLOGICAL STUDIES OF BUCKEYE LAKE, OHIO[1]

WILLIS L. TRESSLER,
Zoology Department, University of Maryland,
LEWIS H. TIFFANY,
Botany Department, Northwestern University,
and
WARREN P. SPENCER,
Biology Department, College of Wooster

The State of Ohio contains only a few small lakes and of these, one of the most important from a fishing and recreational standpoint is Buckeye Lake, located approximately thirty miles east of Columbus. In the summer of 1930 the Division of Conservation of Ohio sponsored and financed an intensive study of this lake under the direction of Mr. E. L. Wickliff, Chief of the Bureau of Scientific Research. The following account deals with the chemical, physical and hydrographical features of the lake and with its contained microscopic life. Investigations were carried out during the period between June tenth and September tenth, 1930. The senior author is responsible for the collection of plankton samples and for the chemical, physical and zooplankton parts, the second author determined the phytoplankton and the junior author the bottom organisms. Samples of bottom organisms were collected by Mr. Lewis Roberts while the zooplankton counts were made by Mrs. E. C. Tressler, who also assisted in the routine work of the laboratory. Dr. E. B. Ruth and Mr. Wilbur Titterington assisted with the identification of bottom organisms. The authors wish to acknowledge with appreciation the assistance of Mr. David Wickliff who greatly furthered the work of the laboratory by his interest in the investigations and in the loan of boats and equipment.

THE LAKE

Detmers (1912) gives the following description of the location of Buckeye Lake: "Buckeye Lake is situated in Licking, Fairfield and Perry counties in ranges 17 and 18, townships 17, 18, and 19. It is a long irregular body of water with its longest

[1]Published by permission of the Conservation Commissioner and the Conservation Council of the State of Ohio.

diameter from east to west extending from 82° 25′ 27″ to 82° 31′ 12″ west longitude, approximately 7⅛ miles from east to west and varying in width from one fourth mile in the eastern portion to a mile and one half at the extreme western end and covering an original estimated area of 4,200 acres (1,700 hectares). Originally used as a reservoir for the Ohio Canal, on May 21, 1894, the General Assembly of Ohio passed an act reserving the reservoir for a public park and summer resort known as Buckeye Lake.

"The site of the lake was a more or less completely tree-covered, impassable swamp. It lay diagonally across the southeast corner of township 17 and almost half across the southern border of township 19. In the center of this area was a long, narrow lake fed by several small streams of which the largest were Buckeye and Honey creeks. The lake drained into the south fork of the Licking River."

The drainage belongs to two systems, the Licking-Muskingum and the Scioto River systems. The principal streams feeding the lake are Buckeye and Honey creeks and the southwest feeder, although there are numerous smaller streams. The main outlet is the overflow near Buckeye Park.

Buckeye Lake has a maximum depth of seven meters and a mean depth of two and a half meters. In only two places does the maximum depth exceed four meters and these are of very limited area. The bottom is, with few exceptions, of a muddy character, although in some places where dredging has been recently done, there are some sand and gravel. The whole lower, eastern portion ends in a large swamp area through which a channel has been dredged to Thornport. There are also large areas of swamp in Honey Creek, Buckeye and Maple Swamp sanctuaries (see Figure 1, which gives the principal weeded and swampy areas). Extending from Seller's Point to Onion Island is the remains of the old tow path, the middle wall of which comes to within half a meter or less of the surface. Winds which sweep down the lake at times cause large waves which thoroughly stir up the entire lake and aid in keeping the water turbid.

METHODS

Weekly readings were made at two stations on the lake, one at a spot directly in front of the laboratory (station 1) where the water was between 2½ and 3½ meters deep, another in the

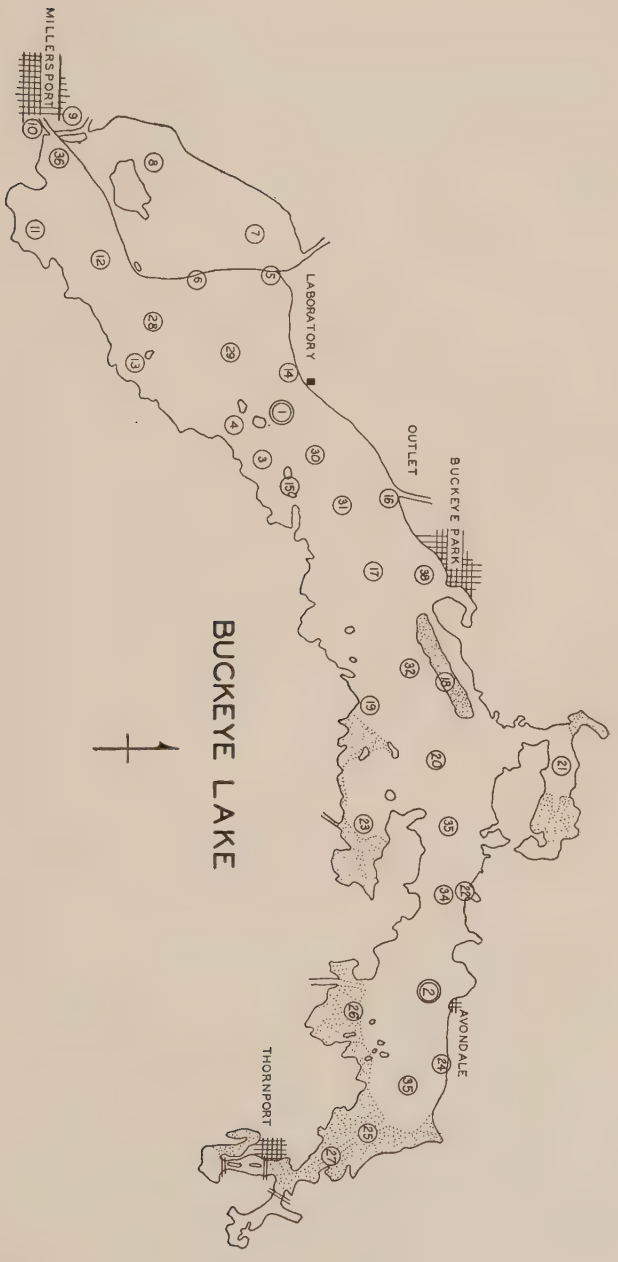

Fig. 1. Map of Buckeye Lake.

deep area off Avondale at the eastern end of the lake (station 2) where five to six meters could be counted on. At station 2, samples were taken at the surface and near the bottom as well but at all other stations surface samples only were secured. Surface samples were taken at a depth of between fifteen and twenty-five cm. Other stations at various points on the lake are shown in Figure 1. Horizontal variation in plankton and environmental factors was investigated on two occasions and a twenty-four-hour series was made to determine diurnal variation.

Temperatures were taken with a Negretti-Zambra deep-sea reversing thermometer and transparency by means of a 10 cm. Secchi disc. Color determinations were made with the standard platinum cobalt solution as recommended by the American Public Health Association (1925). Silica was determined according to Atkin's modification (1923) of the method of Dienert and Wandenbulke (1923) and phosphorus by Atkin's method (1923). Other chemical procedures followed methods recommended by the American Public Health Association (1925) or by Birge and Juday (1911). Water samples for chemical analysis and for plankton were obtained by means of a Kemmerer-Foerst water sampler. One liter of water was centrifuged with a Foerst centrifuge and the plankton obtained was made up to 20 cc. for phytoplankton counting. Duplicate samples of one liter each were also centrifuged and particulate organic matter determined by loss on ignition. Three liter samples of lake water were evaporated to determine the total amount of dry residue. A ten-liter Juday-Foerst plankton trap was used to collect zooplankton and an Eckman dredge 20 cm. by 20 cm. was employed in the collection of bottom samples.

RESULTS OF PHYSICAL MEASUREMENTS

Temperature.—Temperatures at station 1 are shown in Figure 2. The temperature of the water rose steadily as the summer progressed until a maximum was reached about the last of July or the first of August. In Figure 2, air temperatures are shown by the wavy line superimposed on the water temperature curve. These temperatures represent the approximate daily maximum air temperature at the laboratory. It will be noted that while the temperature of the water followed the general trend of the air temperature, there were no sudden changes. A maximum of 29.0° C. was observed on August 5, at station 1. The maximum at station 2, at the eastern end of the lake, was 28.6° C. which occurred on July 29. At station 19, on July 30, a maximum of 30.2° C. was noticed, while on July 12, at 4 p. m. three inches below the surface at a spot about 30 meters off the laboratory, a maximum temperature of 31.0° C. (88° F.) was recorded. The temper-

ature probably reached somewhat higher figures but these were the maxima recorded. The minimum temperature at station 2 was 20.4° C. which occurred on August 26, while the minimum at station 1 was 21.1° C. on August 22. The surface water was considerably cooler at the extreme eastern end of the lake in the channel between the marsh areas. On July 17, at station 27, a temperature of 21.0° C. was noted, which was over six degrees lower than the temperature taken a few minutes later at station 24 in the open waters of the lake where the temperature was 27.6° C. These low temperatures were correlated with high transparency and were possibly due to the protection given by

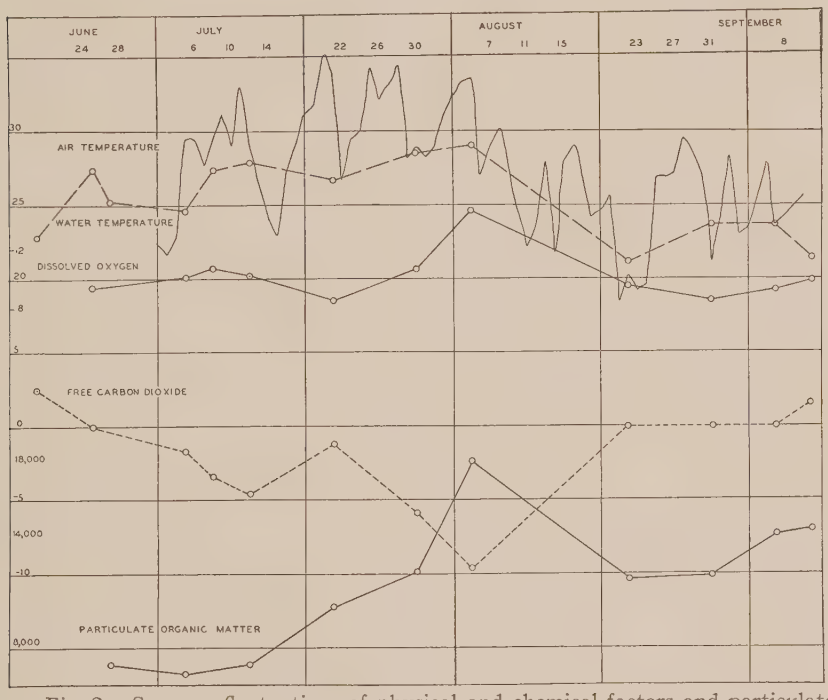

Fig. 2. Summer fluctuations of physical and chemical factors and particulate organic matter at station 1. Temperatures are shown in degrees Centigrade, chemical factors in parts per million, organic matter in milligrams per cubic meter.

the rooted aquatics both from the sun and from wave action and stirring up of bottom water.

In general the temperatures at the eastern station followed those taken at station 1. The maxima and minima occurred at about the same time, although minor fluctuations did not always agree. The maximum amount of vertical stratification in temperature was noticed on June 14, at station 2, where the surface water showed a temperature of 25.6° C., while the water at 6.25 meters depth was 18.6° C.

Transparency.—The waters of Buckeye Lake are of very low transparency. The maximum reading taken with the Secchi disc was only

0.75 meters at station 1. The readings at station 2 were always lower than at station 1 and both stations showed a decline in transparency as the summer progressed, station 1 declining to a transparency of 0.3 meters by the end of the summer. When it is considered that an ordinary lake will show transparencies of from three to 10 meters or more and that the maximum transparency recorded for a lake amounts to 41 meters (Lake Masyuko in Japan), the extremely low transparency of Buckeye Lake may be appreciated. Lakes which are on the average much shallower than Buckeye often have transparencies of from 1 to 3 meters. The low transparency in Buckeye Lake is due to several factors: the enormous phytoplankton crop during the summer, the action of the wind in stirring up the bottom sediments and the amount of organic matter present in the water. On standing for two or three days, the lake water would clear up remarkably, the supernatant liquid showing little color, so that this factor was not important in this instance. In the swamp areas, where the wind had little effect, the readings were considerably higher. At station 27, transparency reached a maximum of 1.75 meters but as this was also the depth of the water at this place, the transparency was undoubtedly considerably greater, since the disc could be clearly seen on the bottom. In the lake itself, these figures were never approached.

Color.—The color of the water after filtering (true color) was about 25 on the platinum-cobalt scale. This is not at all high; many lakes in northern Wisconsin will show colors as high as 200 or 300 units on this scale. The absence of bog waters or of inflow from such regions accounts for the low color of the water of Buckeye Lake.

RESULTS OF CHEMICAL ANALYSIS

Dissolved Oxygen.—The seasonal variation of dissolved oxygen at station 1 is shown in Figure 2. In most lakes, oxygen becomes reduced during the summer months due to the inability of water of higher temperature to hold as much gas in solution. In Buckeye Lake, however, oxygen increased with the increase in temperature and its maximum amount coincided with the period of maximum temperature. This unusual condition was due to the enormous crop of phytoplankton which increased to a maximum at the same time. The greatest amount of dissolved oxygen recorded during the summer was found at station 1 (14.6 p.p.m. on August 5, 188% saturation). The highest figure for station 2 was 12.8 p.p.m. on August 26. On August 26, station 2 also showed the high figure of 11.6 p.p.m. (148% saturation). The minimum oxygen tension observed at station 2 occurred on July 29, at a depth of 5 meters. Here only 1.9 p.p.m. was present, due to decomposition of bottom debris. The bottom waters were never completely saturated during the summer at this station and were usually between 50% and 75% saturated. On July 29, the bottom water was only 23% saturated. In a bog hole on Cranberry Island, the lowest oxygen tension was recorded (1.4 p.p.m., or 15% saturation).

Carbon Dioxide.—Figure 2 indicates summer variation of free carbon dioxide at station 1. Station 2 showed essentially the same

changes. Station 1, however, had a much more even curve than station 2, due to the fact that at station 2 carbon dioxide was constantly replaced by decomposition in the deep hole. High winds mixed the lake from surface to bottom, thus bringing up the accumulated carbon dioxide from the deep hole. For this reason free carbon dioxide was observed at the surface at station 2 as late as July 22, while none was observed during the months of July or August at station 1. The times of minimum free carbon dioxide will be noted to have occurred at the same period as maxima for temperature, oxygen and organic matter. The activity of the lake was at its height at this time in early August. On August 5, the greatest deficiency of free carbon dioxide observed anywhere on the lake occurred at station 1 (9.7 p.p.m.). (That is to say, 9.7 p.p.m. of carbon dioxide would be required to make the water neutral to phenolphthalein). On August 27, a maximum amount of 31.0 p.p.m. was noted in the bog hole on Cranberry Island. The maximum amount observed in the lake itself was at station 2, at 5 meters on August 26, (9.0 p.p.m.).

Fixed carbon dioxide, determined as methyl orange alkalinity, showed some increase as the summer progressed (from 87.2 p.p.m. on June 19, to 95.5 p.p.m. on September 10, at station 1). Station 2 showed an increase of about the same order of magnitude (86.3 on June 28, to 96.5 on August 6). These figures show the waters of Buckeye Lake to be "hard" and largely account for the superabundance of phytoplankton forms.

Hydrogen Ion.—The pH in a general way varied inversely as the free carbon dioxide. The neutral point for free carbon dioxide, however, did not agree very closely with the pH value at the same time, due to the presence of buffers in the water which prevent any sudden change in the pH. The maximum pH observed for the lake was 8.9 on August 5, at station 1. The lowest pH recorded in the lake was 7.3 on July 6, and August 26, at a depth of 5 meters at station 2. Station 1 varied between pH 8.2 and pH 8.9 during the summer. On August 27, at the Cranberry Island bog hole, a pH of 6.8 was recorded. Dachnowski (1939) recorded a minimum pH of 4.0 for certain parts of this bog.

Chlorides.—Determinations of chlorides were made during most of the summer but only a trace was ever observed when correction for the blank on the reagents had been made. This lack of chlorides is due to the freedom from pollution which Buckeye Lake enjoys, a fact also borne out by the low nitrite nitrogen figures.

Nitrogen.[2] Free ammonia nitrogen was present to a maximum amount of 0.146 p.p.m. observed on July 30, at 5 meters at station 2. The remainder of the determinations showed figures ranging from a trace to 0.130 p.p.m., the latter amount occurring in one of the sanctuaries. Ammonia steadily decreased throughout the summer. The same decrease was noted in a shallow Wisconsin lake (Tressler and Domogalla, 1931) and is probably due to the increase in the activity of the denitrifying bacteria in the warmer water. In Buckeye Lake,

[2]The determinations of nitrogen, silica and phosphorus were made by Mr. Harold M. Whitacre to whom acknowledgement is hereby made.

ammonia nitrogen had fallen to 0.006 p.p.m. at stations 1 and 2, while at other stations only a trace remained.

Tests for nitrite nitrogen were made from time to time but indicated either none at all or a trace, which shows the lake to be largely free from sewage pollution.

Organic nitrogen increased somewhat throughout the summer due to the increasing amount of plant material in the lake. On June 26, the surface waters showed 0.470 p.p.m. of organic nitrogen, while on August 21, this had increased to 0.704 p.p.m. Nitrates showed the result of large amounts of plant material in the lake which use up this form of nitrogen. Amounts ranged from somewhat greater than 1.00 p.p.m. to 0.050 p.p.m. The lower figures were observed toward the end of the summer.

Silica.—Dissolved silica in the water ranged from 1.6 p.p.m. to 8.0 p.p.m. Dissolved silica is low in summer due to its utilization by the diatoms in building their shells (Birge and Juday, 1911). There was little rainfall during the summer to add to the amount of silica and this also tended to keep the amount low (Pearsall, 1923).

Phosphorus.—A few determinations of soluble phosphorus showed results ranging from a trace to 0.400 p.p.m., the high amount occurring in one of the sanctuaries. The surface waters of the lake gave an average soluble phosphorus content of about 0.030 p.p.m. The data are insufficient to draw any conclusions as to the summer variation, although determinations made when the activity of the lake was at its height, showed higher figures for both stations 1 and 2 than later in August. The great numbers of plant organisms evidently caused this depletion.

THE ZOOPLANKTON

Ten liters of water collected with a Juday-Foerst plankton trap were reduced to 20 cc. and two 1 cc. samples were counted for zooplankton forms. Results were expressed as the number of organisms per cubic meter.

Buckeye Lake does not support a great variety of zooplankton forms; only seventeen species belonging to sixteen genera were found during the summer. Of these there were two species of copepods, nine of Cladocera and six rotifers. The complete list of species identified during the summer of 1930 is given below.

Copepoda

Cyclops viridis americanus Jurine
Ergasilus versicolor Wilson

Cladocera

Alona quadrangularis (Müller)
Bosmina longirostris (Müller)
Camptocercus rectirostris Schoedler
Ceriodaphnia sp.
Chydorus sphaericus (Müller)
Daphnia retrocurva Forbes
Daphnia sp.
Leptodora kindtii (Focke)
Pseudosida bidentata Herrick
Sida crystallina (Müller)

Rotifera

Brachionus bakerii Ehrenberg
Conochilus sp.
Diglena sp.
Polyarthra trigla Ehrenberg
Rattulus styalatus (Gosse)
Synchaeta sp.

Miscellaneous

Cypria dentifera Sharpe
Hyalella sp.

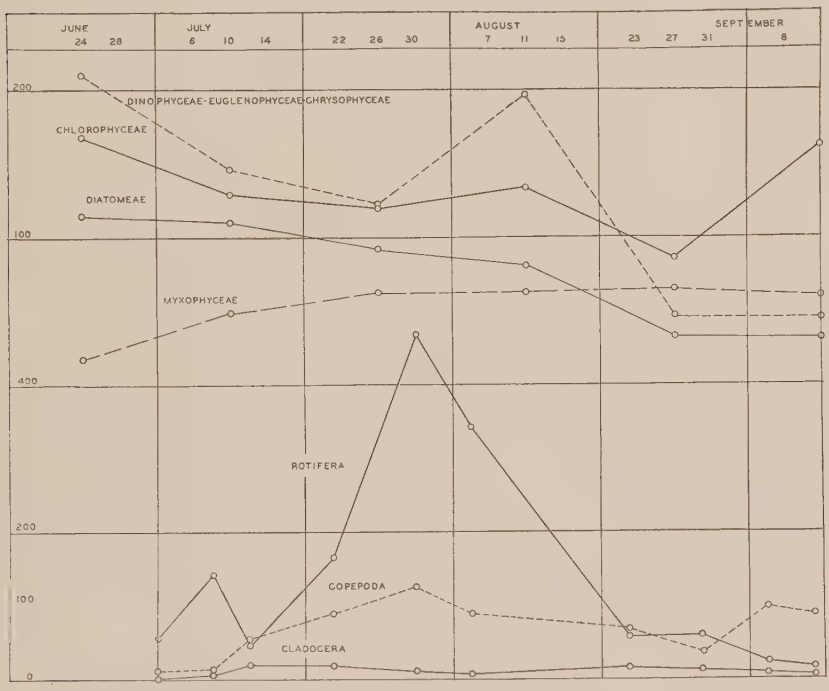

Fig. 3. Summer fluctuations of plankton groups. Phytoplankton is shown as the average number of organisms, in thousands per liter, during each of the two-weeks periods; zooplankton as the average number of organisms per liter.

Summer Fluctuations.—Figure 3 indicates the summer distribution of the various groups of zooplankton at station 1. It will be noted that the time of maximum abundance of the copepods and rotifers was during the midsummer slightly before the period of maximum activity of the lake. Cladocera were never very abundant at any time and appeared in greatest numbers about the middle of July. At station 2 the Cladocera showed very slight fluctuations during the summer. In the weedy areas of the lake there were large numbers of cladocerans but these were forms restricted to such environments and were never found in the limnetic region. The most abundant limnetic cladoceran was

Pseudosida, the summer distribution of which is shown in Figure 4. This cladoceran never exceeded 20,000 individuals per cubic meter. Immature Cladocera were found during the early part of the summer but disappeared after the first week in August from the samples at station 1. The large form, *Leptodora kindtii* was very abundant at the first part of the summer but was seldom taken in the counts, due in all probability to its ability to see and avoid the trap and smaller tow nets. A tow made with a meter net in July showed a pure culture of this large cladoceran in large numbers. The only abundant copepod was *Cyclops*, which was present in fairly large numbers during the entire summer and reached a maximum at one meter depth on August 6, at station 2 (196,000 per cubic meter). At station 1 *Cyclops* had maxima on July 21, (60,000 per cubic meter) and on September 10 (68,000 per cubic meter). Nauplii were found throughout the entire summer in considerable abundance. At station 2, nauplii reached their maximum on September 4, (132,000 per cubic meter) and had shown a steady increase in numbers from the beginning of the summer. At station 1 they were most abundant during July and showed no regular increase during the summer. Of the rotifers, by far the most abundant was *Brachionus bakerii*, which reached a maximum at station 1 on July 30, of 578,000 per cubic meter and was present in large numbers during the entire summer. The summer distribution of some of the other rotifers which were more or less abundant is shown in Figure 4.

Vertical Distribution.—Buckeye Lake is so shallow, even at the deepest part off Avondale, that vertical distribution of zooplankton is of very little significance. There is no thermocline to effect distribution and conditions, except in the case of light, are very much alike from surface to bottom. On rough days one expects to find few animals at or near the surface and the same is true on very bright days. At station 2, the greatest number of organisms occurred at 1 meter depth at all times during the summer with two exceptions, on July 14, which was a cloudy day, the number at the surface exceeded those at 1 meter. On August 18, however, there were more organisms at the surface on a clear sunny day. No explanation is offered for this anomaly of distribution. At station 1, with the exception of the first few observations in July, there were always more copepods at the 3 meter level than at 1 meter. The total number of organisms at station 1, was at most times greater at 1 meter than near the bottom, due to the greater proportion of rotifers in the upper layers.

Horizontal Distribution.—On July 28, a clear sunny day, with no wind, a series of fifteen stations were sampled starting at the western end of the lake and continuing to the eastern end. These samples were taken with the trap at a depth of ¾ meters and between the hours of ten a. m. and noon, so as to avoid differing light intensities. The results indicated a very uneven distribution of organisms, as has been shown on other lakes. Swarming, wind action and other factors play a part in this unequal horizontal distribution of the plankton. Small lakes, with even bottom contours, have been shown to show a fairly regular horizontal distribution of plankton. Buckeye Lake, however, has many islands and is of irregular shape.

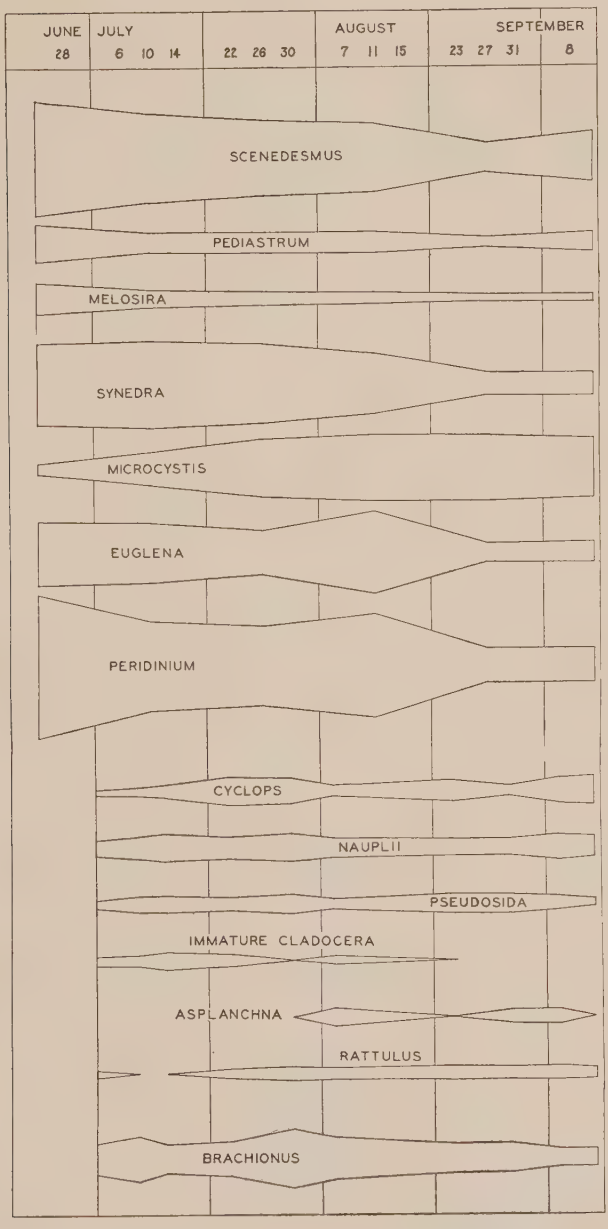

Fig. 4. Summer fluctuations of some of the more abundant genera of plankton organisms. Phytoplankton is shown as the average number of organisms per liter during each of the two-weeks periods; zooplankton as the average number of organisms per cubic meter.

PHYTOPLANKTON

A liter sample of water was collected in the Kemmerer-Foerst water sampler and run through a Foerst centrifuge to obtain the smaller organisms. Each centrifuged sample of plankton was made up to a constant volume (usually 20 cc.). After thorough shaking and mixing of the contents of the sample, one cubic centimeter of the material was withdrawn by a pipette and transferred to a Sedgwick-Rafter cell for counting. Ten random counts from each of two transfers from the sample were made, thus securing twenty counts for each liter sample. The number of algal organisms per liter of sample was then computed and recorded.

A number of stations were established for the survey from which collections were made regularly in some cases and intermittently in others.

In order to be able to make numerical comparisons among numbers of organisms counted, it is necessary to select some standard units. At best, these units can be only approximate in their comparative value and to a certain extent must be arbitrarily chosen. Perhaps some approximation on the basis of gross size furnishes a fairly usable unit. It is almost impossible to make comparisons with the data secured by other workers in cases where no mention is made of the kind of unit used in counting. In this report each unicellular alga is counted as one, regardless of size. Rather definite colonies, such as *Pediastrum*, *Scenedesmus* (4-celled), *Coelastrum*, *Oocystis* and *Microcystis*, are counted as units also in spite of the fact that the number of cells in different colonies varies considerably. The filament forms of varying lengths and sizes and the indefinite colonial forms are the most difficult to enumerate satisfactorily. For some filamentous forms a convenient space on the counting cell was arbitrarily chosen as a unit, the length depending upon the individual cell length of the filament.

The arbitrarily chosen units for some of the filamentous and colonial forms are as follows: *Melosira* 300 μ, *Oscillatoria* 300 μ, *Lyngbya* 300 μ, *Anabaena* 300 μ, *Aphanizomenon* 300 μ, *Dinobryon* 5 cells, *Merismopedia* 16 cells, *Crucigenia* 8 cells.

The following list represents all the algae that could be identified definitely to species. Some occurred very rarely and in too small numbers to enter into the computation of prevalent algae during the survey. In some cases identification was uncertain and such forms are listed merely as "spp."

Chlorophyceae

Actinastrum hantzschii Lagerh.
Ankistrodesmus falcatus (Corda) Ralfs
Closterium acerosum (Schr.) Ehr.
C. acutum Breb.
C. ehrenbergii Menegh.
C. kuetzingii Breb.
C. pronum Breb.
Coelastrum microporum Naeg.
C. sphaericum Naeg.

Cosmarium granatum Breb.
C. radiosum Wolle
C. spp.
Crucigenia emarginata (W. and G. S. West) Schm.
C. rectangularis (Naeg.) Gay
Lagerheimia citriformis (Snow) G. M. Smith
L. genevensis Chodat var. subglobosa (Lemm.) Chodat
L. subsalsa Lemm.
Micractinium pusillum Fres.
Oocystis borgei Snow
Pandorina morum Bory
Pediastrum biradiatum Meyen
P. boryanum (Turp.) Menegh.
P. duplex Meyen
P. simplex Meyen
P. tetras (Ehr.) Ralfs
Pleodorina illinoisensis Kofoid
Pleurotaenium coronatum (Breb.) Rabenh.
P. trabecula (Ehr.) Naeg.
Scenedesmus acuminatus (Lagerh.) Chodat
S. armatus (Chodat) G. M. Smith
S. bijuga (Turp.) Lagerh.
S. denticulatus Lagerh.
S. dimorphus (Turp.) Kuetz.
S. obliquus (Turp.) Kuetz.
S. quadricauda (Turp.) Breb.
Schroederia setigera (Schroeder) Lemm.
Selenastrum bibraianum Reinsch
Sorastrum spinulosum Naeg.
Spondylosium papillosum W. and G. S. West
Sphaerocystis schroeteri Chodat
Staurastrum spp.
Tetraedron enorme (Ralfs) Hansg.
T. minimum (*A. Br.*) Hansg.
T. muticum (A. Br.) Hansg.
T. regulare Kuetz.
Treubaria varia Tiffany and Ahlstrom
Trochiscia aspera (Reinsch) Hansg.
Volvox globator L.

Myxophyceae

Anabaena circinalis (Kuetz.) Rabenh.
A. flosaquae (Lyng.) Breb.
Aphanizomenon flosaquae (L.) Ralfs.
Chroococcus minutus (Kuetz.) Naeg.
C. turgidus Naeg.
Coelosphaerium kuetzingianum Naeg.
Gloeotrichia natans (Hedw.) Rabenh.
Lyngbya aestuarii (Mert.) Liebm.
L. major Menegh.
Merismopedia elegans A. Br.

M. glauca (Ehr.) Naeg.
M. tenuissima Lemm.
Microcystis aeruginosa Kuetz.
M. flosaquae (Wittr.) Kirch.
M. marginata (Menegh.) Kuetz.
Nostoc linckia (Roth) Born.
Oscillatoria limosa Ag.
O. princeps Vauch.
O. tenuis Ag.
Phormidium retzii (Ag.) Gom.

Diatomeae

Asterionella gracillima (Hantz.) Heib.
Caloneis trinodis (Lewis) Boyer
Cocconeis placentula Ehr.
Cymbella affinis Kuetz.
C. ventricosa Kuetz.
Fragilaria capucina Desm.
Gomphonema constrictum Ehr.
G. parvulum (Kuetz.) V. H.
Gyrosigma acuminatum (Kuetz.) Cleve
Melosira crenulata (Ehr.) Kuetz.
M. distans (Ehr.) Kuetz.
M. varians Ag.
Meridion circulare (Grev.) Ag.
Navicula cryptocephala Kuetz.
N. cuspidata Kuetz.
N. lanceolata Kuetz.
N. radiosa Kuetz.
N. spp.
Nitzschia linearis W. Smith
Surirella splendida (Ehr.) Kuetz.
Synedra pulchella (Ralfs) Kuetz.
S. ulna (Nitz) Ehr.
Tabellaria fenestrata (Lyng.) Kuetz.

Euglenophyceae

Euglena oxyuris Schm.
E. spirogyra Ehr.
E. spp.
Phacus longicauda (Ehr.) Duj.
P. pleuronectes (O. F. M.) Duj.

Dinophyceae

Ceratium hirundinella (O. F. M.) Schrank
Peridinium spp.

Chrysophyceae

Dinobryon sertularia Ehr.
Synura uvella Ehr.

PERIODICITY AND RELATIVE ABUNDANCE

Transeau (1916) established the class "ephemerals" for the plankton algae collected in his survey of the ponds and streams of Illinois. Taking the organisms as a whole, he found plankton species most abundant in May and June, with a lesser maximum in October. The reports of Birge and Juday (1922) for Wisconsin, Burkholder (1929, 1930) for eastern Lake Erie, Muenscher (1928, 1930) for New York and unpublished data for western Lake Erie all indicate rather definite plankton periodicity in large bodies of water. Eddy (1927) has reported monthly abundance of some plankton forms in small lakes in central Illinois. It is unfortunate that the survey of Buckeye Lake did not extend through a longer period, from the standpoint of data for periodicity. It will not be possible to make definite comparisons with previous workers because of the limited season covered in this survey.

In reporting the periodicity of phytoplankton in Buckeye Lake, the time covered by the survey has been divided into periods of two weeks. The first half and the last half of each month are used arbitrarily as the two-weeks periods and the number of individuals is recorded for each period (Figures 3 and 4). The connecting lines in the graphs do not represent actual gradations between successive periods: they merely connect successive two-weeks enumerations. It is interesting to note that as a whole the Chlorophyceae are more abundant in June and September, corresponding to Transeau's findings for Illinois (*supra*). The Diatomeae begin with a maximum in June, gradually decreasing to a minimum in early September. The Myxophyceae show an early minimum in June with a maximum in July and August. The Dinophyceae-Euglenophyceae-Chrysophyceae group (including the genera *Peridinium*, *Ceratium*, *Euglena*, *Phacus*, *Dinobryon* and *Synura* and for convenience considered here as a single class) show two maxima: one in June and the other in early August, with a marked drop to a minimum in late August and early September.

The periodicity of a few common genera (*Synedra*, *Melosira*, *Microcystis*, *Scenedesmus*, *Pediastrum*, *Peridinium* and *Euglena*), which occurred rather consistently throughout the survey, is shown in Figure 4. These genera indicate a periodicity quite comparable to that of the groups to which each belongs (Figure 3). The periodicity and abundance of other genera will be discussed later under the proper class of algae.

It is not known what effect the extremely dry season of 1930 had upon the abundance of plankton algae. The water in Buckeye Lake was lower than any previously known record.

Chlorophyceae.—The two most abundant genera of this class are *Scenedesmus* and *Pediastrum* (Figure 4). The former is represented by seven species and the latter by five species. Next in abundance is *Cosmarium*, occurring throughout the season in gradually increasing quantities until the end of the survey. *Tetraedron*, together with *Cosmarium*, is at variance with the Chlorophyceae considered as a whole. The remaining genera (Table II) of the Chlorophyceae occurred in too small quantities to warrant individual consideration.

The Chlorophyceae is the dominant group for Buckeye Lake for the whole season (Figure 3; Table I). Occasional cycles of *Peridinium* and *Euglena* are very abundant during certain periods (see below) and at these times the green algae seem scarce by comparison. The dominance of the Chlorophyceae in Buckeye Lake is in striking contrast to conditions in Lake Erie, where the diatoms are the evidently preponderant

TABLE I

CLASSES OF PLANKTON ALGAE IN BUCKEYE LAKE. AVERAGE NUMBER OF ORGANISMS, IN THOUSANDS PER LITER OF WATER. DURING EACH OF THE TWO-WEEKS PERIODS

	June 25–30	July 1–15	July 16–31	August 1–15	August 16–31	September 1–10
Chlorophyceae	168	129	120	133	87	162
Diatomeae	114	110	92	81	32	31
Myxophyceae	18	48	62	62	65	60
Dinophyceae, Euglenophyceae, Chrysophyceae	208	146	123	196	46	45

TABLE II

CHLOROPHYCEAE. AVERAGE NUMBER OF ORGANISMS, IN THOUSANDS PER LITER, OF GENERA OF CHLOROPHYCEAE, DURING EACH OF THE TWO-WEEKS PERIODS

	June 25–30	July 1–15	July 16–31	August 1–15	August 16–31	September 1–10
Scenedesmus	105.0	80.0	68.0	62.0	26.0	46.0
Pediastrum	34.0	17.0	16.0	16.0	8.0	18.0
Cosmarium	10.0	10.0	15.0	26.0	33.0	66.0
Tetraedron	8.0	9.0	10.0	14.0	14.0	22.0
Crucigenia	4.0	2.0	4.0	3.0	2.0	4.0
Closterium	2.0	3.0	2.0	1.0	0.3	0.0
Oocystis	1.0	3.0	4.0	3.0	0.3	5.0
Coelastrum	2.0	0.6	1.0	1.0	0.3	1.0
Sphaerocystis	1.0	0.2	0.03	0.2	0.0	0.0
Staurastrum	3.0	1.0	2.0	2.0	0.3	1.0
Pandorina	0.5	2.0	1.5	2.0	0.0	0.0
Kirchneriella	0.0	0.3	0.4	0.2	0.3	0.0
Euastrum	0.0	0.8	0.3	0.01	0.0	0.0
Eudorina	0.0	0.0	0.1	3.0	0.3	1.0
Dictyosphaerium	0.0	0.05	0.0	1.0	0.0	0.0

group. In addition the maximum abundance of this group is not reached in Lake Erie until September. The relative rapidity with which the water of Buckeye Lake becomes warm in the spring is perhaps an important factor in the Chlorophycean maximum in June in such a relatively small lake.

Eddy (1927) found in a small lake in Illinois a maximum of Pediastrum in July, with a marked rise in June over May and a marked

decline in August. A second smaller maximum was noted in October. This July maximum in Illinois is, however, less than one half the phytoplankton productivity in Buckeye Lake for the same period. Muenscher (1929) reports a maximum of 500,000 organisms (nannoplankton) per liter in Lake Champlain in early August. A representative station from Lake Erie might show a maximum of 400,000 organisms per liter in August, with a count of 35,000 in September. The maximum production of Chlorophyceae at any one time for Buckeye Lake occurred in August with a count of 272,000 per liter. This should not be confused with the average counts for the two-weeks periods, mentioned above.

Diatomeae.—Ranking second to the Chlorophyceae, the diatoms occur rather regularly throughout the season but with relatively few species in abundance (Figure 3; Table I). The enormous "waves" of

TABLE III

DIATOMEAE. AVERAGE NUMBER OF ORGANISMS, IN THOUSANDS PER LITER, OF THE GENERA OF DIATOMEAE, DURING EACH OF THE TWO-WEEKS PERIODS

	June 25–30	July 1–15	July 16–31	August 1–15	August 16–31	September 1–10
Synedra	75.0	81.0	72.0	54.0	20.0	21.0
Melosira	29.0	14.0	11.0	9.0	5.0	6.0
Navicula	7.0	7.0	3.0	3.0	5.0	2.0
Surirella	2.0	1.5	0.4	0.5	1.0	0.0
Gyrosigma	1.0	5.0	4.0	7.0	1.0	1.0
Asterionella	0.5	0.5	0.0	0.0	0.0	0.0
Tabellaria	0.0	0.0	2.0	0.0	0.0	0.0
Amphora	0.0	0.1	0.04	0.0	0.0	0.0
Nitzschia	0.0	0.0	0.5	0.0	0.0	0.0
Cocconeis	0.0	0.0	0.5	0.0	0.0	0.0

Stephanodiscus, *Asterionella*, *Tabellaria* and *Fragilaria*, so characteristic of Lake Erie, were missing in the survey of Buckeye Lake. *Stephanodiscus* was not observed at all and the other genera occurred only sparingly in June and July. The dominant diatom throughout the season is *Synedra*, followed not closely by *Melosira* and *Navicula*. These genera are most abundant at the beginning of the season and apparently least abundant in late August and early September. Some other data for previous years indicate a rise in numbers for a short time during late September. *Surirella*, a diatom found perhaps more frequently in water with a higher organic content, follows the general seasonal distribution of the class as a whole. *Gyrosigma* is present throughout the season, though never abundant and is more common during early August. *Cymbella*, *Cocconeis* and *Nitzschia* were rarely observed. (Figure 4; Table III).

The autumn maximum of productivity of diatoms reached in Lake Erie is notably absent in Buckeye Lake. From a representative Lake Erie habitat there may be 300,000 organisms per liter in September and nearly 600,000 per liter in October, corresponding to only 31,000 in

September (no data for October) in Buckeye Lake. The month of August furnishes an interesting comparison (New York data from Muenscher, 1929); Buckeye Lake 159,000; Lake Erie 328,000; Lake Champlain 70,000; Upper Saranac Lake 40,000; Lower Saranac Lake 60,000; Middle Saranac Lake 50,000; Lake Placid (on July 10, 10,000 organisms per liter). Maximum numbers are considered only.

TABLE IV

MYXOPHYCEAE. AVERAGE NUMBER OF ORGANISMS, IN THOUSANDS PER LITER, OF THE GENERA OF MYXOPHYCEAE, DURING EACH OF THE TWO-WEEKS PERIODS

	June 25–30	July 1–15	July 16–31	August 1–15	August 16–31	September 1–10
Microcystis	9.0	28.0	52.0	58.0	60.0	53.0
Anabaena	3.0	2.0	2.0	2.0	1.0	1.0
Lyngbya	2.0	12.0	3.0	3.0	3.0	3.0
Coelosphaerium	0.5	2.0	4.0	0.3	0.0	0.0
Aphanizomenon	1.0	3.0	0.6	0.3	0.0	0.0
Merismopedia	0.0	0.1	1.0	2.0	2.0	4.0
Gomphosphaeria	2.0	0.0	0.1	0.0	0.0	0.0
Oscillatoria	0.0	0.0	0.0	0.0	0.1	0.0

TABLE V

DINOPHYCEAE, EUGLENOPHYCEAE, CHRYSOPHYCEAE. AVERAGE NUMBER OF ORGANISMS, IN THOUSANDS PER LITER, OF THE GENERA OF DINOPHYCEAE, EUGLENOPHYCEAE AND CHRYSOPHYCEAE, DURING EACH OF THE TWO-WEEKS PERIODS

	June 25–30	July 1–15	July 16–31	August 1–15	August 16–31	September 1–10
Peridinium	129.0	80.0	70.0	92.0	28.0	27.0
Euglena	58.0	55.0	38.0	77.0	16.0	19.0
Ceratium	14.0	7.0	6.0	15.0	1.0	0.0
Phacus	5.0	3.0	2.0	3.0	2.0	0.0
Dinobryon	0.5	0.3	0.04	0.0	0.0	0.0
Synura	0.0	0.0	1.0	0.0	0.0	0.0

Myxophyceae.—It has been established in numerous collections that the blue green algae are decidedly summer and autumn forms. In the Buckeye Lake survey there is a steady rise in abundance from a low minimum in June to a maximum in late August and early September. In Lake Erie the Myxophycean maximum occurs in September (1938). When one considers the temperature of the water, however, it might be just as well to consider the blue greens "warm water" forms. Their absence in spring and early summer seems to be accounted for pretty largely on the basis of low temperature of water.

In the Buckeye Lake survey *Microcystis* is the only member of the plankton consistently present (Figure 4; Table IV). *Anabaena*, though

not very abundant at any time is present in largest numbers in early summer. The very shallow water along shore in 1930, particularly in protected places, became warm much earlier in the year than is usually the case. *Lyngbya* occurs most abundantly in early July. Both *Coelosphaerium* and *Aphanizomenon* are absent in late August and early September. For other genera see Table IV.

TABLE VI

GROUPS OF ZOOPLANKTON IN BUCKEYE LAKE. AVERAGE NUMBER OF ORGANISMS, IN THOUSANDS PER CUBIC METER, IN EACH OF THE TWO-WEEKS PERIODS

	July 1–15	July 16–31	August 1–15	August 16–31	September 1–10
Copepoda	34.0	108.0	88.0	53.0	93.0
Cladocera	11.0	16.0	7.0	15.0	7.0
Rotifera	52.0	316.0	342.0	59.0	20.0

TABLE VII

ZOOPLANKTON ORGANISMS IN BUCKEYE LAKE. AVERAGE NUMBERS OF ORGANISMS, IN THOUSANDS PER CUBIC METER, OF THE GENERA OF COPEPODA, CLADOCERA AND ROTIFERA FOR EACH OF THE TWO-WEEKS PERIODS

	July 1–15	July 16–31	August 1–15	August 16–31	September 1–10
Copepoda					
Cyclops	13.0	61.0	58.0	39.0	61.0
Nauplii	21.0	45.0	30.0	14.0	32.0
Cladocera					
Daphnia	0.5	0.25	0.0	0.0	0.25
Pseudosida	5.0	13.0	4.0	14.0	6.0
Ceriodaphnia	0.0	0.5	0.0	0.0	0.0
Immature Cladocera	6.0	2.0	2.0	2.0	0.25
Rotifera					
Asplanchna	0.0	0.0	9.0	2.0	2.0
Polyarthra	0.0	0.5	6.0	2.0	1.0
Brachionus	51.0	312.0	324.0	51.0	13.0
Rattulus	0.25	4.0	4.0	6.0	4.0

Muenscher (1929) reports a maximum of 500,000 organisms per liter during early August in Lake Champlain and 400,000 in Lake Placid. In Lake Erie a maximum for the same period may be 500,000 per liter, while in Buckeye Lake the count runs only as high as 154,000 for the same month.

Dinophyceae.—Peridinium and *Ceratium* are unusually well represented in this survey (Figure 4; Table V). Their curve of distribution indicates a first maximum in June with a second in early August. The autumn maximum, characteristic of Lake Erie, is absent. The decline in late August and early September is very marked.

Peridinium occurs at times in tremendous quantities, the largest count being 672,000 on August 1. On the same day the count for *Ceratium* was 14,000 organisms per liter.

Euglenophyceae.—Euglena is the dominant genus, reaching a maximum in early August with a lesser maximum in June and early July (Figure 4). *Phacus* occurs rather regularly, though in much smaller numbers throughout the season.

Chrysophyceae.—Dinobryon and *Synura* are the only representatives of this class, the former occurring throughout June and July, the latter in late July only. They are perhaps not an important part of the phytoplankton.

If these last three classes of phytoplankton are considered as a unit, we get the high maximum of productivity in June, declining rapidly till the end of the survey in September (Figure 3; Table I; Table V).

DIURNAL CHANGES IN THE LAKE

Small bodies of water, shallow streams and fish ponds have been shown to exhibit marked changes in their chemistry during the 24 hours, while it has long been known that certain plankters perform daily, vertical migrations from one region of the lake to the other. At the time that Buckeye Lake was investigated little was known about the diurnal changes in a good sized lake and especially of the factors which caused the changes and differences in distribution of various plankton organisms. Even today, the subject is still more or less shrouded in mystery and no complete explanation has been given to explain many of the very complex migrations exhibited by some organisms.

On August 12–13, a 24-hour series of surface samples were taken every hour from a point about 100 meters off the laboratory. Zooplankton, phytoplankton, temperature, dissolved gases, pH and alkalinity were investigated. The chemical determinations were made immediately after the collection of the water. The results of chemical determinations and migrations of certain zooplankters are shown in Figure 5.

The following weather report for Columbus, kindly submitted from the Weather Bureau Office by Mr. W. H. Alexander, indicates that the afternoon of August 12 was quite similar to the forenoon of August 13, with the possible exception of the amount of sunshine.

"August 12, 1930, was a clear day with 100% of possible sunshine; the temperature ranged from 54 (the minimum) to 78 (the maximum) degrees Fahrenheit, averaging 66, or 8 degrees below normal; the wind was from the north and northwest with an average hourly velocity of 5.9 miles per hour, the highest velocity for the day being 14 miles.

"August 13, 1930, was also a clear day but with only 88% of the possible sunshine; it began clouding in the late afternoon and evening; the temperatures ranged from a minimum of 48 to a maximum of 85, giving an average of 72 or 2 degrees under the normal for the day; the winds were rather variable though the prevailing winds were from the northwest and the average velocity was 5.4 miles per hour with a maximum for the day of 14 miles from the south."

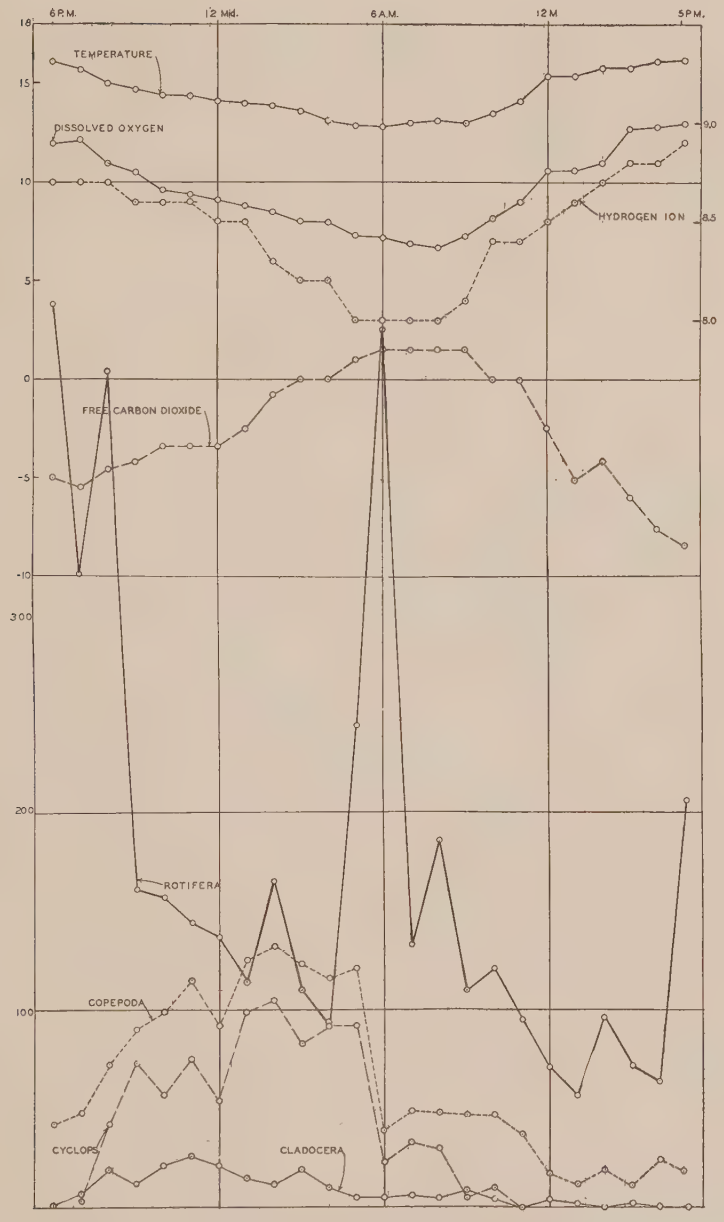

Fig. 5. Diurnal changes in physical and chemical factors and in zooplankton at the surface on August 12–13, 1930. Temperature is shown in degrees Centigrade, chemical factors in parts per million, plankton in organisms per liter; time is eastern standard time.

Physical and Chemical Changes.—The days selected for the observations thus turned out to be ideally suited for such an investigation. Water temperature was observed to lag behind air temperature during the 24 hours. The variation in water temperature amounted to only 3.4° C. while that of the air was 13.9° C. at the laboratory, clearly illustrating the difference in specific heat of the two mediums. The activity of the green plants in the water caused marked fluctuations in dissolved oxygen, free carbon dioxide and pH. Dissolved oxygen varied between 6.7 p.p.m. and 13.0 p.p.m., the lowest figure having been reached at 8 a. m., before the sun had been up long enough to make its presence felt in photosynthesis. The percentage of saturation showed even greater fluctuations and varied between 77% and 159%. This variation was due to the fact that the period of least oxygen occurred at a time when the water was able to hold more dissolved gas due to its lower temperature. Methyl orange alkalinity, as would be expected, remained at a practically constant level during the entire time. Free carbon dioxide, however, showed rather remarkable changes from hour to hour as the activity of the green plants varied with the amount of sunlight. By the first of August and for some time before, free carbon dioxide had been exhausted at the surface and a decided deficiency was noted at most times. During the 24 hour series, carbon dioxide varied from a deficiency of 5.0 p.p.m. at the start to actual free carbon dioxide between four and ten a. m. By 5 p. m. that afternoon a deficiency of 8.4 p.p.m. had been built up due to photosynthesis of the green plants. The pH varied inversely with the free carbon dioxide and ranged between 8.0 and 8.9.

The Zooplankton.—At the bottom of Figure 5 is shown the diurnal distribution of the major groups of zooplankton. The only copepod present was *Cyclops viridis americanus* and this species is represented separately as being the principal migrant. The graph marked "Copepoda" includes the immature stages as well as adults of this species. Both of these curves show higher numbers of individuals at the surface during the hours of darkness. In very bright light the adult copepods deserted the surface completely and were absent from nine a. m. until late afternoon. The nauplii, on the other hand, although not nearly as abundant at the surface during the hours of intense sunlight, were nevertheless present in fair numbers. Light intensity seems therefore, to be an important factor in the migration of adult copepods in Buckeye Lake.

The rotifers showed a distinctly different type of migration. The time of maximum numbers at the surface will be seen in Figure 5 to coincide with the time of sunrise and sunset, or at a time of diffuse light. Sume crustaceae have also been shown to prefer diffuse light (Juday, 1902), but in Winona Lake, where these observations were made, there was no morning increase observed to correspond with the evening maximum. The rotifers in Winona Lake were found by Juday to show no indication of a diurnal migration. This is perhaps due to the different genera there (*Mastigocera*, *Polyarthra*, *Asplanchna*, *Keratella*, *Triarthra* and *Notholca*). In Buckeye Lake by far the greatest number of rotifers were of the genus *Brachionus*.

The Cladocera, which never reached any great number in the open water of the lake, followed in general the migrations of the copepods,

being at the surface during the night and deserting it with the appearance of the sun during the daytime.

The Phytoplankton.—It is difficult for one to appreciate the significance of the "peaks" of the curves in the diurnal periodicity of the phytoplankton, due to the fact that collections were made but once each hour on this particular occasion. Factors other than those incident to the mere changes from hour to hour are not known. The Chlorophyceae reached a corresponding peak at 3:00 p. m., 5:00 p. m., 7:00 p. m. and 2:00 a. m., being consistently lowest from 4:00 a. m. until noon. The Myxophyceae and Diatomeae were fairly regular throughout the 24 hours. The three other classes were most abundant immediately after noon. The quantity of Chlorophyceae and Dinophyceae-Euglenophyceae-Chrysophyceae was considerably lower, on the average, at noon of August 13, than at 1:00 p. m. the preceding day. The available sunshine decreased also. Very little variation was noted in the diatoms and blue-greens.

PRODUCTIVITY

Buckeye Lake is a eutrophic lake which exhibits extremely high productivity during the summer months. Particulate organic matter, shown for station 1 in Figure 2, ranged from 6600 mgs/m^3 to 18,100 mgs/m^3 at this station. At station 2 the surface waters ranged from 5,900 to 13,600 mgs/m^3. 18,100 mgs/m^3 was the maximum amount of organic matter observed at any time in the lake in 1930. That this figure represents a truly enormous amount, may be appreciated when it is recalled that Birge and Juday (1934) in a study of 529 Wisconsin lakes found particulate organic matter to range from 230 to 12,000 mgs/m^3 with a mean of only 1,360. The time of maximum organic matter in Buckeye Lake occurred at the same time as the maximum zoo- and phytoplankton abundance and in general the summer variation followed very closely the total counts for these organisms. During the height of activity of the lake in early August, the water was so densely populated with algae that it truthfully may be said to have appeared like pea soup. This overpopulation is reflected in the high organic matter and in the extremely low transparency of the water at this time.

In its vertical distribution, particulate organic matter at station 2, showed a greater amount at the surface than at 5 meters in three instances and more at the bottom in two; at other times the amount was about the same at both depths. The larger amount at the surface may be explained by the greater amount of plankton at this level, while stirring up of bottom debris may account for the larger amount at the bottom on the two occasions. The vertical distribution of organic matter has been shown to be very variable in different lakes.

The horizontal distribution of organic matter was very irregular. In general, the stations at the western end and in the sanctuaries showed more organic matter and the least amount was observed at stations 25 and 27 (1,700 and 2,300 mgs/m^3 respectively). This is reflected in the greater transparency found at these stations. The organic matter was also low in the bog hole on Cranberry Island (2,100 mgs/m^3). Station 1 in Buckeye Lake varied between 168,300 and

212,800 mgs/m³ of dry residue while station 2 showed a maximum of 228,400 mgs/m³ at 5.5 meters on August 18. The surface waters of station 2 varied between 177,000 and 201,700 mgs/m³ of dry residue. Lake Wingra, a small lake of comparable depth in Wisconsin, averaged 271,000 mgs/m³ for the year (Tressler and Domogalla, 1931). Other factors besides the plankton enter into these results. These are the debris which is stirred up from the bottom by high winds and which accounts for the higher figures obtained at 5 meters at station 2 and drainage from the land, which was not a factor of importance during the first part of the summer.

The combined results of particulate organic matter and dry residues show very clearly the extreme eutrophy of Buckeye Lake during the summer months.

BOTTOM ORGANISMS

Procedure.—An Eckman dredge, 20 cm. by 20 cm. was used to collect samples of the bottom. The date, approximate depth and position of the station were recorded at the time the sample was taken and in most cases the nature of the bottom (mud, sand or gravel) was recorded. The samples were placed in four gallon pails and covered with lake water. Within an hour of the time the samples were taken they were washed through a net made of silk bolting cloth, No. 36, which had 13 strands to the centimeter. The sample, washed free of mud, was then transferred to a quart or two-quart jar, marked and left at the laboratory for removal and identification of the organisms. Samples which were not immediately examined were preserved by the addition of formalin. It was found that the counts of *Tanypus* and *Chironomus* larvae and *Limnodrilus* were made about as well from formalin as from fresh material. Such soft bodied forms as the Hydracarinae and *Chaoborus* were, however, largely lost in formalin material.

The laboratory procedure was as follows: About 25 cc. of the sample, consisting of the debris and the organisms, which had been held back by the silk net were placed in a flat glass dish and a little fresh lake water poured over it. This was closely inspected, frequently stirred and worked over and the organisms picked out with forceps and either identified immediately and tabulated or put aside in vials, marked and later identified. No attempt was made to isolate and identify the plankton crustaceans, such as ostracods and cladocerans, some of which were often found in the samples. *Hyalella,* however, was counted as it is a much larger form. Only a few mematodes were taken from the fresh samples, although they undoubtedly occur in great numbers in the mud of the lake bottom. From the size of those found now and then in the samples, it is likely that the great majority went through the meshes of the net. It is also true that these forms are almost at the edge of visibility with the naked eye and for this reason most of them would be missed, particularly in the preserved material. In many samples Bryozoan statoblasts were observed in large numbers. No attempt, however, was made to keep a record of them as they float in the lake water at the season the samples were taken and many of them

no doubt came from the water used in washing the sample and not from the sample itself.

The Data.—A tabular summary of the organisms collected in the 246 samples has been made and together with a map of the lake showing the exact location of each station, is on file at the office of the Division

TABLE VIII

SUMMARY OF BOTTOM ORGANISMS. THE TOTAL NUMBER OF ORGANISMS COLLECTED AT VARIOUS STATIONS FOR EACH MONTH IS SHOWN. THE GRAND TOTAL FOR THE SURVEY AND THE PERCENTAGE OF THE TOTAL FOR THE MORE IMPORTANT ORGANISMS ARE ALSO GIVEN

	July	August	September	Total	Per Cent Total
Diptera					
Palpomyia	15	52	13	80	0.77
Corethra	45	266	133	444	4.26
Tanypus	1623	2444	959	5026	48.29
Chironomus	928	1111	516	2555	24.74
Coleoptera					
Donacia	3	0	0	3	.....
Cybister	0	0	1	1	.....
Hemiptera					
Corixa	0	1	9	10	.....
Ephemerida					
Hexagenia	0	0	2	2	.....
Caenis	1	0	4	5	.....
Odonata					
Didymops	0	0	3	3	.....
Nehallenia	2	0	9	11	.....
Trichoptera					
Leptocerus	1	0	0	1	.....
Hydroptilidae	13	3	7	23	.....
Neuroptera					
Sielis	87	53	16	156	1.5
Crustacea					
Hyalella	71	114	137	332	3.09
Arachnida					
Hydracerina	3	60	55	118	1.13
Mollusca					
Musculium	63	21	1	83	0.81
Oligochaeta					
Nais	0	0	5	5	.....
Branchiura sowerbyi	2	9	4	15	.....
Limnodrilus	743	233	511	1487	14.89
Hirudinea					
Herpobdella	2	2	1	5	.....
Glossophionidae	1	0	0	1	.....
Nematoda	0	0	16	16	.....

of Conservation at Columbus. In Table VIII is given a list of the organisms collected and identified with the total numbers secured in each month, the total collected during the summer and the per cent of the total of some of the more abundant forms. The samples were all taken at depths of between 0.2 and 3.7 meters so that depth plays an insignificant part in the distribution of these organisms in Buckeye Lake. In

other deeper lakes a regular zonation correlated with depth has been observed. This was shown very nicely in a recent paper by Townes (1938) on the bottom organisms in Chautauqua Lake, where small chironomids were found in shallower sandy parts, while in the deeper water, where muck bottom prevailed, *Limnodrilus*, *Chaoborus*, *Tanypus* and larger species of *Chironomus* were found.

An inspection of the summary in Table VIII shows that almost all the forms belong either to the chironomid larvae or to the tubificid worms. Of the total of 10,408 organisms recorded, there are 2,575 or about 25 per cent *Chironomus*, 5,026 or nearly 50 per cent *Tanypus*, 444 or over 4 per cent *Chaoborus* and 1,487 or 14 per cent *Limnodrilus* or closely related genera of tubificids. Thus over 75 per cent by number of the forms are chironomids and less than 10 per cent of the forms come from groups other than chironomids and tubificids. With the abundance of chironomids it may be noted that there are practically no mayfly larvae. Buckeye can certainly be classed as a chironomid lake.

Certain of the facts noted can best be discussed by taking up the major groups of organisms collected individually.

Diptera.—As the chironomids formed by far the most abundant organisms from the bottom samples, a representative lot were weighed, live, dry and ashed. The following data were obtained:

Name	No. of Individuals	Wt. of Empty Dish	Live Wt. With Dish	Dry Wt. With Dish	Ash Wt. With Dish
Chironomus.....	84	17.4063	19.4285	17.5565	17.4371
Tanypus.....	139	19.1496	19.4385	19.1795	19.1536

If the individuals taken represent a fair sample of the total collected, then the organic matter of the total *Chironomus* larvae collected (2,555) would amount to 3.630 grams and that of the total *Tanypus* collected (5,026) would be 0.936 grams. It is obvious that while *Tanypus* is more abundant, the *Chironomus* larvae represent a much larger amount of food material by weight. Records were not kept of the variation in size of *Chironomus* and *Tanypus* from month to month as it seemed that the investigators were dealing with several different species, the identification of which was too difficult to make a study of growth feasible. It may be stated, however, that large numbers of extremely small *Chironomus* and *Tanypus* were found in the September counts. These must have been recently hatched individuals. This would agree with the observations on the swarming of adults around the lake in late August and the opening days of September.

It seems likely that *Chaoborus* occurs relatively more abundantly than recorded. Many individuals were doubtless lost in the formalin samples owing to the extremely fragile nature of this larva. This form certainly cannot, however, be of the importance of the other two genera as food for young fishes in Buckeye Lake.

Neuroptera.—156 *Sialis*, 1.5 per cent of the total organisms found were recorded. On the basis of the amount of organic matter in four individuals, which was determined, the total amount of organic matter

in the 156 *Sialis* collected was estimated to be 0.876 grams, a figure comparable with that obtained for the total *Tanypus* catch. While the numbers were small, it would seem that this form was relatively less abundant in September than in July, which probably indicates that the adults were emerging at this time of year.

Trichoptera, Odonata, Ephemerida, Hemiptera, Coleoptera.—These forms of insect life seem to occur only sporadically. The bottom of the lake being mostly mud, it seems likely that many micro-mayflies may have been overlooked in the samples. It is also probable that many more of the above orders would be found if the animal life on and around submerged water plants were studied. In any estimate of the total food material available to young fishes in a lake such as Buckeye, it would seem that that part of the fauna living on submerged vegetation should be taken into consideration. This very abundant animal life is accounted for neither in bottom nor plankton studies. Chandler (1937) has shown recently that a large part of the plankton of a lake is lost, when the water leaves the lake by way of stream, by being caught up by the detritus on the outside of submerged vegetation. The same thing very probably is true of plankton in weedy areas of a lake and very likely is an important factor in accounting for the increased transparency of the water in the weeded areas at the eastern end of the lake.

Arachnida and *Crustacea.*—Water mites were found rather abundantly in certain samples. The distribution of *Hyalella* was found to be sporadic, 112 of the 322 recorded specimens coming from one sample. This form is probably better considered with the plankton than with the bottom fauna.

Annelida.—Only five leeches were found. Small tubificid worms occurred widely distributed and abundant at many stations. A number of these were examined and from their external anatomy, setae, etc., they were placed in the genus *Limnodrilus*. Some of these may, perhaps have been *Tubifex*, as a careful examination of the individual specimen is necessary to separate these genera. *Nais* was likely present much more often than the counts indicate but it lies on the border of visibility with the naked eye and would often be overlooked.

From the zoologist's viewpoint, by far the most interesting item turned up during the summer's work was the finding of fifteen specimens of the gilled annelid, *Branchiura sowerbyi*. A more detailed description of this interesting worm is given in another paper (Spencer, 1932). This is the first record of this rather rare species from the western continent. It has formerly been recorded from the Royal Botanical Society's gardens, Regents Park, London, the Botanical Gardens of Hamburg and of Göttingen, from several canals and ponds in France, from India and Japan. The worm is a tubificid with a series of some sixty pairs of gill-like respiratory processes, one pair to a segment on the posterior third of the worm. The gills extend at right angles to the long body axis, in the mid-dorsal and mid-ventral lines. They diminish in length anteriorly becoming mere knobs and finally disappearing entirely. Several of these worms were kept alive and under observation in the laboratory for several days and a careful study was made of their

behavior, external anatomy and setae. *Branchiura sowerbyi* was taken at six different stations, which indicates that the worm is fairly well distributed in the central part of the lake. If it is an introduced species, it must have been established for several years to have gained its present distribution in the lake. Where it has been found in other regions it has not been taken in large numbers. Stephenson (1912) bases his description on seven specimens taken in India and Beddard's original paper (Beddard, 1892) is based on about the same number of individuals.

Nematoda, Gordiacea.—Nematodes are probably abundant but too small to be observed readily without the use of a microscope and are often washed through the net. Very few Gordiacea were found.

Mollusca, Bryozoa.—Half a dozen or so small specimens of snails, classified as *Physa, Planorbis* and *Limnaea* were taken but were not tabulated. A small bivalve occurred in some numbers. It was tentatively classified as *Musculum*, although this may not be correct. One bivalve about five centimeters long and unidentified was taken at station 185.

A bryozoan colony was found in the sample from station 167. As already stated many bryozoan statoblasts were seen but were not recorded.

SUMMARY

1. During the summer of 1930, from June 25, to September 10, an extensive study of Buckeye Lake was carried out under the auspices of the Division of Conservation of Ohio. Buckeye Lake is a long, narrow lake located about thirty miles east of Columbus, Ohio, which has a maximum depth of about seven meters and a mean depth of around two and one half meters.

2. The temperature reached an observed maximum of 29.0° C. at the surface. The transparency varied between 0.3 and 0.7 meters, low figures being due to the great abundance of plankton material and the shallowness of the lake. The color is low, about 25 on the platinum-cobalt scale.

3. Dissolved oxygen was present in abundance at all depths, except at five meters and below in the deep hole, due to the decomposition on the bottom. Free carbon dioxide was present later in the summer than in most lakes due to the decomposition of the bottom materials and to the lake's shallowness. Methyl orange alkalinity reached a maximum of 96.0 p.p.m., showing the waters to be hard. The pH varied between 7.3 and 8.9 in the limnetic regions. Chlorides were found in minute traces only. Soluble phosphorus was low during the summer; dissolved silica was not very abundant. Nitrates were fairly low due to their consumption by algae. Free ammonia declined to a low point by the end of the summer.

4. Rotifers were the most abundant zooplankton organisms.

5. The Cladocera were never present in great numbers in the limnetic region.

6. Of the copepods, *Cyclops viridis americanus* was the most abundant species.

7. The lake reached a maximum of activity during the first week in August. At this time there was more oxygen, more plankton and the temperature was the highest; organic matter was also at a maximum.

8. The zooplankton organisms were found to be unevenly distributed over the limnetic area of the lake and occurred in patches or swarms here and there.

9. The Chlorophyceae was the dominant group for the lake during the period covered by the survey and reached a peak in June and another in September. Most abundant genera were *Scenedesmus* and *Pediastrum*.

10. The Diatomeae varied in abundance from a maximum in June, gradually decreasing to a minimum in early September. The dominant diatom was *Synedra*, followed not closely by *Melosira* and *Navicula*.

11. The Myxophyceae varied from a low minimum in June, gradually increasing to a maximum in late August and early September. The most abundant blue-green alga was *Microcystis*.

12. The Dinophyceae, represented by *Peridinium* and *Ceratium*, reached a first maximum in June with a second in late August. The decline in early September was very marked.

13. The Euglenophyceae, as shown by the presence of *Euglena*, reached a maximum in early August preceded by a lesser maximum in late June and early July. *Phacus*, though present in small numbers throughout the survey, showed no definite periodicity.

14. The Chrysophyceae was an unimportant group of the algal plankton of the lake. *Dinobryon* occurred in June and July and *Synura* in late July only.

15. Studies of the diurnal changes over a 24 hour period showed considerable fluctuation both in chemical determinations and in migrations of plankton.

16. The particulate organic matter was extremely high (maximum of 18,000 mgs/m^3. Dry residue reached a maximum of 228,400 mgs/m^3. Buckeye Lake is therefore an extremely productive lake of the eutrophic type.

17. The bottom of Buckeye Lake was sampled for bottom organisms; 246 samples were taken with an Eckman dredge, 20 cm. by 20 cm.

18. The chironomid larvae formed over 75% by number of the bottom organisms recorded. *Limnodrilus* formed about 15%.

19. There was almost a complete absence of mayfly larvae.

20. *Branchiura sowerbyi*, a gilled tubificid worm, was found at six stations in the central part of the lake. 15 specimens were taken in the bottom samples. This is the first record of this form in the western hemisphere.

LITERATURE CITED

American Public Health Association. 1925. Standard methods of water analysis· xi-119 pp. New York.

Atkins, W. R. G. 1923. The phosphate content of freshwater and salt water in relation to the growth of algal plankton. Jour. Mar. Biol. Assoc. **13** (1): 119–150.

Beddard, F. E. 1892. A new branchiate Oligochaete (*Branchiura sowerbyi*). Quart. J. Micr. Sci. **33**: 325.

Birge, E. A., and **C. Juday.** 1911. Inland lakes of Wisconsin. Dissolved gases and their biological significance. Wis. Geol. and Nat. Hist. Bull. **22**: 259 pp.

1922. Inland lakes of Wisconsin. The plankton. I. Its quantity and chemical composition. Wis. Geol. and Nat. Hist. Bull. **64**. ix-222 pp.

1934. Particulate and dissolved organic matter in inland lakes. Ecol. Monogr., **4** (4): 440–474.

Burkholder, P. R. 1929. Microplankton studies of Lake Erie. Suppl. 18th. Ann. Report N. Y. State Conservation Dept., 60–66.

1930. Microplankton studies of Lake Erie. Bull. Buffalo Soc. Nat. Sci. **14** (3): 73–91.

Dachnowski, A. P. 1939. The growth of natural vegetation as water cultures. Sci. Month., **48** (3): 232–237.

Chandler, D. C. 1937. Fate of typical lake plankton in streams. Ecol. Monogr., **7** (4): 445–479.

Detmers, Fredrica. 1912. An ecological study of Buckeye Lake. Proc. Ohio State Acad. Sci., **5** (10): 138 pp.

Dienert, F., and **F. Wandenbulke.** 1923. Sur le dosage de la silice dans les eaux. C. R. Acad. des Sci., Paris, **176**: 1478–1480.

Eddy, S. E. 1927. A study of algal distribution. Trans. Amer. Micros. Soc., **46**: 122–128.

Juday, C. 1902. The plankton of Winona Lake. Proc. Indiana Acad. Sci., 120–123.

Muenscher, W. C. 1928. Plankton studies of Cayuga, Seneca and Oneida lakes. Suppl. 17th Ann. Rep. N. Y. State Conserv. Dept., 140–157.

1930. Plankton studies in the Lake Champlain Watershed. Suppl. 19th Ann. Rep. N. Y. State Conserv. Dept., 146–163.

Pearsall, W. H. 1923. A theory of Diatom periodicity. Jour. Ecol., **11** (2): 165–183.

Spencer, W. P. 1932. A gilled oligochaete *Branchiura sowerbyi* new to America Trans. Amer. Micros. Soc., **51** (4): 267–272.

Stephenson, J. 1912. On *Branchiura sowerbyi* Beddard and a new species of *Limnodrilus* with distinctive characters. Trans. Roy. Soc. Edinb. **48**: 285–304.

Tiffany, L. H. 1938. Algae: the grass of many waters. C. C. Thomas publisher.

Townes, H. K. 1938. Studies on the food organisms of fish. Suppl. 27th Ann. Report N. Y. State Conserv. Dept., 162–175.

Transeau, E. N. 1916. The periodicity of freshwater algae. Amer. Jour. Botany, **3**: 121–133.

Tressler, W. L., and **B. P. Domogalla.** 1931. Limnological studies of Lake Wingra. Trans. Wis. Acad. Sci. Arts and Letters. **26**: 331–351.